FRACTURED DISCOURSE: SOCIAL REPRESENTATIONS OF SHALE GAS DEVELOPMENT VIA HYDRAULIC FRACTURING

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ABSTRACT

Herein I investigate the nature and emergence of social representations of shale gas development (often called "fracking"). Social representations are common sense understandings of complex, novel phenomena generated in the public sphere via communal discourse. I triangulate between results from (1) a content analysis of regional newspaper coverage, (2) in-depth interviews, (3) field visits to communities discussing and engaged in development, and (4) a survey of residents in areas experiencing development and/or heightened discourse about potential development. My results reveal that these representations: (1) are limited in scope, (2) often relate to difficult to quantify social effects of development that are value-based, (3) are ethically-derived, (4) are historically-, culturally-, and socially-dependent, and (5) *predict* (rather than derive from) beliefs about effects of development. The grounding of key representations in values and ethical considerations intimates a very different public understanding of this issue than one in which representations are based primarily on potential economic and environmental effects of shale gas development, such as job creation and water contamination. The limited scope of representations highlights an expansive range of topics that are neglected in discourse on shale gas development. The causal primacy of summary views of development over beliefs

about effects of development is this dissertation's most striking finding. Contrary to much empirical research on public perceptions of development and theoretical background applied to understanding these perceptions, both the data herein and social representations theory support valenced positions on shale gas development *leading to* beliefs about likelihood of impacts of development occurring, and to beliefs about the effects of those impacts on quality of life. This connotes substantial challenges for communicating about shale gas development in a way that affects summary views on this issue; likewise it portends further obstacles to alighting on policies/regulation of development that the public will broadly accept. I discuss the implications of all the aforementioned findings for communication about and policy on shale gas development. Finally, I reflect on the value of social representations theory for studying social psychology of energy development and offer recommendations for further improving the methodological rigor of social representations research.

BIOGRAPHICAL SKETCH

Darrick Evensen grew up in a small farming and mining community in eastern New York State, outside of Albany, close to Massachusetts and Vermont. Here he developed two primary attributes: a love of the outdoors and a love of learning.

Darrick's undergraduate years took him to Princeton University, where he majored in public policy and international affairs, with concentrations in environmental studies and European cultural studies. These academic pursuits came together in his senior thesis, in which he examined the Allemansrätt system in Sweden and investigated how it fosters human engagement with natural areas.

The year between his undergraduate and graduate studies saw Darrick engage in reflection. Since his sophomore year at Princeton, he desired to become a professor, but after graduating, he sought time in nature before continuing to study human interactions with the natural world. He taught middle school children at an alternative environmental school, *Nature's Classroom*, in Connecticut for four months. For sixty-two days in the spring of 2007, he hiked the Appalachian Trail from Georgia to Pennsylvania. At *Nature's Classroom* Darrick received the name "Nighthawk". He used this name on the Appalachian Trail; many of his closest friends only call him "Nighthawk" today.

Every summer from 2004-2007, Darrick worked as a wilderness guide at a Christian summer camp in the Adirondack Mountains focused on environmental stewardship. He led 12-18 year old children on week-long backpacking, canoeing, and kayaking excursions, serving as their guide, cook, medic, comedian, raconteur, and chaplain. In the summer of 2007, he met his future wife, Katherine, at this camp. They led multiple excursions together; their journeys continue to this day.

In August 2007, Darrick began his graduate studies at Cornell University. The outspoken but eager student found a dedicated advisor and researched public perceptions of wildlife diseases for three years, leading to his MS degree – conferred in January 2011. As his research interests shifted in a more sociological direction, Darrick switched advisors, expanded his faculty committee, and selected social representations of shale gas development as his PhD research topic. From his MS work, Darrick learned that he wanted to focus his PhD on something that mattered deeply to the residents of the communities in which he would be conducting his field work. Darrick was not disappointed. Few topics have instigated as much discussion, debate, and discord as this one has in the small towns and villages of New York, Pennsylvania, and the Province of New Brunswick (where Darrick conducted his research). Many of these communities reminded Darrick of his own childhood in a rural, natural resource-driven community. His insights into these communities, their people, their values, and their discourse populate the pages that follow.

I dedicate this dissertation to those communities and individuals struggling with the issue of shale gas development. May they seek and find insight.

ACKNOWLEDGMENTS

A dissertation is far more than content. It contains a corpus of research, but it comes into being due to the capacity of a doctoral student to dedicate the necessary time, effort, and insight to its conception, writing, and revision. In this sense, the dissertation before you would not have been possible without the support of an eclectic group of friends, mentors, and guides.

I must first recognize my faculty committee. Professors Katherine McComas and Dan Decker have been with me from the beginning of my MS degree, seven years ago. They exercised great patience as they gradually but continually helped me grow as an empirical researcher and a critical thinker. Professors David Brown and Todd Walter joined my committee later on, after I began my PhD. Both gentlemen brought substantial expertise and vision from areas into which I was concertedly expanding my inquiry – sociology/sociological social psychology and natural scientific evaluation of physical landscape variables. David and Todd contributed meaningfully to my growth as a well-rounded academic.

Beyond academic guidance and insight, a vision of how to live well as a whole person helped me complete the research and writing contained herein. The ability to come into my campus office daily and laugh, joke, and muse about topics entirely unrelated to my research made the occasional tedious moments of my PhD work much more bearable. My office mates were great friends – not simply colleagues or associates – they contributed to my whole existence, not just a delimited "office-related" portion. Whether due to their kindness, ever-present peaceful nature, sage advice, incessant humor, capacity to listen well, or their ability to understand without me even needing to explain, these friends contributed to my success over the last

seven years: Christine Moskell, Heather Triezenberg, Jeffrey Jacquet, Ted Lawrence, Alex Kudryavtsev, Nirav Patel, and Santi Joy Saypanya.

Whether in my office or not, my Department of Natural Resources friends contributed substantially to my experience here, which afforded me both the insight and peace to complete this dissertation. In many ways, the Natural Resources community furthered my experience in a manner that surpassed the role of each of the individual members. I cannot recognize all the friends who made my time at Cornell and in Ithaca so memorable, but I must single out Laura Martin, Laura Eierman, Morgan Ruelle, and Paul Simonin.

At Cornell, I also had the great fortune of attracting many true friends outside of my department. The ways in which we met are often inexplicable and difficult to recall, but I know that we will be friends for life. These people kept me sane by constantly reminding me of how much more there is to life than just my research; as friends, they are unequalled. I express my sincere gratitude to: Captain Brian Buchanan, Ben Brown-Steiner, Josephine Archibald, Toni Sacco, Graham Dixon, Sasha Korn, and Chris Clarke.

My next acknowledgement goes to someone whom I have never met and who speaks a different language than I do. Serge Moscovici, the father of social representations theory, contributed greatly to this dissertation by giving me an extremely nuanced and well-conceived theory to apply to my research. Social representations theory requires many different methods, which makes the research process exciting, never boring, and always changing. Moscovici, with his lucid and engaging texts and ideas, brought me vision, wisdom, and enjoyment during this dissertation.

Beyond my professors at Cornell, I pause here to recognize several administrators who substantially shaped my college experience, and while not directly

influencing my dissertation, they instilled in me a desire to enter university administration at some future juncture. While serving with these individuals as a Cornell University Trustee, I learnt much about academia that neither research nor dissertation writing can ever teach. My thanks go to David Skorton, Kent Fuchs, Barb Knuth, Susan Murphy, and Steve Johnson.

Having named a range of faculty, friends, and administrators at Cornell, I now acknowledge a man who fits each of these titles. Rich Stedman, my advisor, put in an enormous amount of effort to help me become an insightful sociologist who can think on his feet. He accompanied me on every step of my journey as I designed studies, pondered findings, analyzed mountains of data, and triumphed in interesting results. Rich and I attended several conferences together, shared the experience of driving 850 miles cross-country in a 12-passenger van, played numerous rousing games of Texas Hold'em, and met for several beers at the Chapter House or in the park. Rich played *the* central role in helping me transform from an eager student to a professor.

Finally, I recognize my family. My supportive parents, Don and Kathy, and my wild brother, Tyson, were with me every step of the way. For decades they have encouraged me towards this PhD; I believe all three of them knew before I did that the life of the professor would best suit me and be most enjoyable for me. To my wife, Katherine, I afford my final recognition. Katherine listened patiently as I babbled on (and on) about esoteric theories and obscure relationships manifest in my data. She helped me envision the path my research would take and helped to ground me as a whole person – not becoming lost in my work. Even with our soon-to-be daughter on the way, she tolerated my perpetual recondite musings and exclamations.

To all my friends, family, and mentors: thank you for your vision, guidance, and love. This dissertation is our joint accomplishment.

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Chapter One: Introduction

"The limits of my language mean the limits of my world."
-- Ludwig Wittgenstein, *Tractatus Logico-Philosophicus*[1]

What first comes to mind when you read/hear "shale gas development via hydraulic fracturing"? Think of your own response before you continue reading. Knowing your own answer to this question will make the next several hundred pages of reading about other people's thoughts and feelings on this topic much more engaging.

I. Overview

For this dissertation research, I sought to understand and characterize what people think of when they hear "shale gas development" (or "fracking"), and to describe why those words and images that come to mind are most accessible. This was an exploration in social psychology – I looked for and identified individual and societal-level factors affecting discourse, knowledge, and beliefs about shale gas development. I studied individual beliefs and values, societal-level communication, local history, political and regulatory approaches, and social structure.

My investigation has important implications for communication and policy about shale gas development. To communicate effectively about this topic, one would benefit from knowing what people think about this issue, why they have those thoughts, and how thoughts vary across geographic, social, and cultural contexts. If policy is to respond to constituents' concerns and interests, knowing what those concerns and interests are could make policy development much easier. Additionally, policy could meet with substantial resistance if it does not account for the public's conceptions of the thing being regulated.

Before I continue, I must define two key phrases I use throughout this document:

[1] While the introductory quote might seem apropos as the point of departure for any doctoral dissertation, I also include this quote due to its applicability to social representations theory.

- *Shale gas development* – the full range of processes and outcomes associated with shale gas exploration and extraction via high volume slick-water hydraulic fracturing. This includes, but is not limited to: leasing, seismic testing, site preparation, drilling, extraction, processing, transport, and distribution. It also includes concomitant changes in the local communities and landscapes, and effects on a range of ancillary businesses and industries. In common parlance (e.g., newspaper, television, radio, the diner, the town hall, the bar), and even in many academic and government documents, the word "fracking" is used synonymously with my conception of "shale gas development". I mostly avoid the word "fracking" because it can limit the focus on this complex series of processes and effects to a single stage in the development process (i.e., the hydraulic fracturing itself), it can lead to confusion about what processes and outcomes people are talking about, and the word carries clear negative bias.
- *Social representations* – common sense understandings of complex, novel phenomena that are generated in the public sphere by means of communal discourse. I explain this concept in depth in Chapter Two.

In this dissertation, I explore social representations of shale gas development. I was interested in SR of shale gas development because shale gas development is a contentious issue that has potential to transform residents' lives in the areas where it occurs. This transformation can be positive and/or negative and can exist through multiple social, environmental, and economic effects. I studied social representations of this issue in the USA and Canada, but conversations about shale gas development pervade discourse in many other nations as well, including: the UK, France, Australia, The Netherlands, and Poland. Over the last few years, numerous pieces of municipal, state/provincial, national, and even international legislation have been debated (and many have been passed) on this topic. Furthermore, myriad impact studies have been conducted and a vast number of citizens have mobilized via campaigns and protests both in favor of and opposition to shale gas development.

I researched the ways in which people communicate about and conceptualize shale gas development; I did not examine the technical processes related shale gas development. Nevertheless, because these processes do contribute to representations, I offer a brief background (for an in-depth, lucid, and laconic primer, see Duggan-Haas *et al.* 2013).

Hydraulic fracturing is one of many steps in the development of shale gas, but this process most clearly differentiates it from "conventional" gas development (i.e., the type of development that has been occurring in the USA and throughout the world since 1821). Hydraulic fracturing for fossil fuels has been occurring for over 60 years in the United States. Two relatively new developments, horizontal drilling in combination with high-volume water injection, have changed how this process is conducted. The current form of high-volume, slick-water hydraulic fracturing used for extracting oil and gas from shale and tight sand formations uses millions of gallons of water, along with smaller amounts of sand-based proppant and chemicals (e.g., biocides, friction reducers), to create microscopic fractures in rock formations that allow tightly-held pockets of oil or gas to escape and travel up the well bore to the surface. This form of hydraulic fracturing is used after a well has been drilled vertically down into the earth for several thousand feet and then curved until it extends horizontal to the surface. The horizontal portion can extend for more than a mile.

Hydraulic fracturing *itself* occurs when the fluid described above is injected into the well under high pressure and it cracks the shale. The proppant keeps the fractures open, allowing the fossil fuels to escape into the well bore. A host of other processes needed for developing a well site and extracting fossil fuels accompany hydraulic fracturing. For example, water, proppant, and chemicals need to be delivered to a well site; the well site itself needs to cleared and graded; used water from the fracturing job needs to be treated and/or disposed of at the surface.

Each of the many processes associated with development can have environmental, economic, and social effects at local, regional, and national scales. For my dissertation research, I was not interested in "hydraulic fracturing". Rather, I was interested more broadly in shale gas development via hydraulic fracturing for two primary reasons: (1) hydraulic fracturing represents

a very narrow, limited, and singular stage in an extremely complex process, and even more importantly (2) public communication on this issue does not focus on hydraulic fracturing. Even when the word "fracking" is used, much more is discussed than highly pressurized fluid cracking sedimentary rock. As Wittgenstein asserts, "The limits of my language mean the limits of my world." I sought to study real life communication about this issue in the public sphere. The nature of the discourse shaped the focus of my research. As I present my research findings throughout this dissertation, I describe in detail the additional process and impacts associated with development.

II. Goals for this Research

Two central goals pervaded my research. They guided the questions I asked, the methods I used, the data I collected, the ways in which I analyzed the data, and the selection of the results I present in the following pages. First, I aimed to generate findings that could provide roads forward in communication and policy on this contentious topic. Second, I desired to investigate the utility of social representations (SR) theory for examining social psychology of energy development in North America. These broad goals led me to the following research questions (discussed in greater detail in Chapter Three):

1. To what extent can public perceptions of shale gas development about hydraulic fracturing be characterized as *social* representations?
2. What are the most frequently employed SR of shale gas development? How, and to what extent, does context affect commonality of SR?
3. Which social structural, cultural, historical, and physical landscape factors influence SR of shale gas development most heavily? Why, and to what extent, do these factors differ across contexts?
4. What are the implications of SR of shale gas development for communication about this issue (e.g., from government, industry, and non-profit organizations)?

5. What are the implications of SR of shale gas development for policy development about this issue (e.g., on local, state, and national levels)?
6. How do SR of shale gas development relate to support for sustainable and resilient communities?

III. The Remaining Chapters – An Outlook

I conclude this Introduction with a brief synopsis of the eight chapters that follow. I highlight the major focus and substantial sub-topics in each chapter and, where relevant, emphasize notable findings.

In Chapter Two, I provide the theoretical basis for my research. I define social representations, explain how they form, and provide historical background on the genesis and usefulness of social representations theory. I then situate social representations theory within social psychology by comparing it with other social psychological theories. I then clarify how social representations research applies to shale gas development, and finally elucidate the ways in which I amend and use social representations theory for my dissertation research.

Chapter Three covers my methodology and methods. A wide range of methods contribute to this chapter's considerable length; I used newspaper content analysis, in-depth interviews, and a survey as my primary data collection methods. I employed qualitative coding and numerous statistical approaches for analyzing data. I begin the chapter by discussing the *methodology* (i.e., the approach to and rationale for data collection and analysis) and methods demanded by social representations research. I then review methods used in recent empirical research on social representations, highlighting strengths and weaknesses. I introduce the methods I used and present my rationale and criteria for selecting the communities in which I conducted my studies. I then discuss the various data collection and analysis techniques I used, illustrating how each subsequent study of mine built off the findings of the previous one.

Chapter Four is the first of three results chapters; in each of these chapters I describe the results of one major study. I begin Chapter Four by presenting descriptive statistics from my

content analysis of newspaper coverage on shale gas development across four regional newspapers (two in New York and two in Pennsylvania). I explain differences between newspapers in their attention to impacts associated with shale gas development. I also examine valence attributed to those impacts.[2] Water quality, jobs, lease/royalty income, and non-specific environmental and economic impacts were by far the most commonly cited in the newspapers. Few other impacts were mentioned regularly; social impacts were notably absent. While differences do exist between newspapers, general patterns are manifest across all coverage. I follow my cross-newspaper and cross-impact comparisons by analyzing variation in impacts mentioned across years of coverage – coverage of environmental and economic impacts decreased over time. I conclude with data from four interviews with the most prolific journalists on this topic from the four newspapers in the analysis. I use their thoughts to contextualize some of the content analysis findings.

Chapter Five contains the data from my in-depth interviews with 47 key informants in New York, Pennsylvania, and the Canadian province of New Brunswick. These interviewees were heavily engaged in shaping or facilitating discourse on shale gas development. I begin by describing briefly the nine communities where I completed my field work (three each in NY, PA, and NB). I then discuss the representations that emerged as important in the interviews and the channels by which these representations spread. As I depict each representation, I report differences in representations across communities. Representations included references to specific impacts of development (e.g., water, jobs, economic growth, traffic, road quality, public health, outdoor recreation), but my interviewees most frequently cited representations related to "soft" (i.e., difficult to quantify) social issues, such as: (1) potential disruption to beauty, peace, and quiet, (2) unwanted change, (3) necessary change, (4) polarization and division, (5) destruction of the good life, and (6) fostering the good life. Other major representations

[2] I discuss "impacts" frequently in this dissertation. Because "impact" has a variety of academic meanings, I must note that I define this word in line with the Oxford English Dictionary (2014): "the act of impinging", "the effective action of one thing or person upon another". Therefore, an impact is something that makes an impression; it exerts force upon people to think or act in some way. Any effect of shale gas development that is recognized by a person as meaningful for some reason could, thus, be an impact.

included: (1) interviewees on all sides of the issue stating that people on their side care for the community while those on the other side are greedy and selfish, (2) perpetual misinformation about the degree to which other people are misinformed about this issue, and (3) community history as an important influence on representations. I conclude Chapter Five by chronicling ways in which interviewees used ethical claims to represent shale gas development, notably through appeals to procedural justice.

In Chapter Six, I introduce the results of my survey of a stratified, random sample of residents from 17 municipalities in southern NY and 17 municipalities in northern PA (N=1202). I present: (1) descriptive statistics, (2) results from a non-respondent follow up, (3) correspondence analyses of open-ended data, (4) generalized linear models that compare results across municipalities, and (5) linear regressions, factor analyses, and structural equation models that highlight factors influencing representations. I organize the data around their ability to speak to research questions 1, 2, 3, and 6 above. The data reveal the polarizing nature of shale gas development. In accord with the interviews, social impacts were considered more likely to occur and as having a greater effect on quality of life than environmental and economic impacts. Ethical considerations were reported as highly important for decision making on this topic. Valence (i.e., positive and/or negative language) was extremely prevalent in the open-ended data and correlated strongly with different types of impacts (i.e., positive with economic, negative with environmental). Local information sources (i.e., local newspapers, friends and family, community members) were the most important means for learning about this issue. Perhaps the most interesting and important finding was from a series of factor analyses and structural equation models that indicated, contrary to extant academic literature in this area, support for / opposition to shale gas development *lead to* beliefs about impacts (rather than vice versa).

Chapter Seven is the first of two implications chapters. Herein I answer research questions 4 and 5 above – offering implications of my findings for communication about and policy on shale gas development. I organize the chapter by sequentially reviewing seven key results and expressing each finding's implications, first for policy and then for communication. I

elucidate the importance of representations being: (1) limited, (2) "soft", (3) ethically-derived, (4) historically-, culturally-, and socially-dependent, (5) unexpectedly divergent (in some cases), (6) *social* (as opposed to individual), and (7) valenced.

In Chapter Eight, my second implications chapter, I explain the ways in which (1) my research has advanced methodological approaches for studying social representations and (2) how my studies can potentially expand the geographical scope in which social representations are applied to social psychological research. Chapter Nine is my Conclusion, in which I discuss future directions for my own research and introspectively reflect on the lessons I learned from completing this dissertation.

Chapter Two: Theoretical Approach

"In theory, theory and practice are the same. In practice, they are not."
"It is the theory that decides what can be observed."
-- Albert Einstein

I. Theory's Purpose

When identifying a theoretical approach for my dissertation research, I searched for a theory that could help me characterize public perceptions of shale gas development in a way useful for local governance, for decision making about state- and provincial-level policy, and for informing communication from government and non-governmental actors. I ultimately alighted on social representations theory, which is, at its core, a way to enumerate and characterize the common sense meanings that society and its members assign to complex and often controversial issues. Fundamentally, this theory explains how knowledge and beliefs develop in society. It provides the researcher with systematic ways to understand how groups/people think about and discuss major social/policy issues; it offers a framework for determining the processes by which those thoughts and discussions come to be.

In this chapter, I first define social representations through a brief review of theoretical work in this area (i.e., what are social representations and for what can they be used?). I then explain the processes by which social representations emerge in society. After establishing this basic understanding, I provide historical background on whence social representations theory derives, linking it to Durkheim's concept of collective representations, and back even further to the philosophy of Immanuel Kant. I then compare social representations theory to other sociological and social-psychological theories, identifying similarities and differences. I explain why I alighted on social representations theory. Fifth, I classify social representations as a theory within sociological social-psychology; I discuss why this is important for the research I undertook. Sixth, I link social representations theory to the content focus of this dissertation, explaining why social representations are relevant for understanding shale gas development via

hydraulic fracturing. Finally, I reflect briefly on the minor ways in which I amended social representations theory for use in my research.

II. What are Social Representations?

Serge Moscovici, who developed the concept of social representations (hereafter "SR") and coined the term in 1961, has described SR broadly as a "series of propositions which enable things or persons to be classified, their characters described, their feelings and actions explained" (Moscovici 2001a, 152). SR theorists and researchers affirm that SR exist as an alternative to and often as an outgrowth of scientific thought and discourse. SR are complex ideas, processes, and objects translated into common sense that is accessible and applicable in everyday life (Wagner and Hayes 2005). The role of the SR researcher, according to Clémence (2001, 83), "is to study common sense knowledge about abstract objects or theories." The fact that social actors create and mold SR is also essential; as noted by Billig (1993, 42): "It is a central theme of the social representationists that psychological states are *socially produced*" (emphasis added). They emerge from discourse in the public sphere (Habermas 1989). Wagner and Hayes (2005, 310) highlight the relative import of social (as opposed to individual) processes in fostering SR when they assert that SR emerge via "the translation of sociostructural and cultural conditions into individual dispositions."

SR integrate pre-existing knowledge and beliefs about the world into novel ideas and knowledge, while at the same time transforming these new concepts from complex to accessible language. Moscovici (2001a, 13) builds off this function of SR to describe them as a "Creole" (i.e., a new language) of common sense distilled from complex scientific ideas. For something to be "common" sense, it must be intelligible in light of what an individual or population already knows and believes; therefore, social representations exhibit a "historical contingency" (Newell 1994, 495) and arise in part from "a social *a priori*" (Wagner and Hayes 2005, 322). They build upon shared history, experiences, and culture.

Moscovici (1988) identifies three primary forms of SR: hegemonic, emancipated, and polemical representations. Hegemonic representations "can be shared by all the members of a highly structured group – a party, city or nation – without their having been produced by the group" (Moscovici 1988, 221). These SR are held by everyone, have the ability to coerce people into action, and are difficult to change because they are so widely accepted and engrained in society. Emancipated representations "are the outgrowth of the circulation of knowledge and ideas belonging to subgroups that are in more or less close contact" (Moscovici 1988, 221). In this case, representations are more subject to evolution and amendment. Finally, polemical representations are "generated in the course of social conflict, social controversy, and society as a whole does not share them. They are determined by the antagonistic relations between its members and intended to be mutually exclusive" (Moscovici 1988, 221).

Jost and Ignatow (2001) argue that while this categorization into three primary types of SR is potentially useful, the existence of these three forms needs to be studied more and evaluated empirically. It is unlikely, however, Moscovici ever meant to suggest that representations of different phenomena fit these three categories perfectly. Rather, as someone who was cautious and critical of Durkheim's regimented bifurcation of representations into individual and collective, Moscovici assumably intended these three divisions as points on a set of continua. They speak to the degree to which: (1) a representation is shared within a society, (2) the representation can be easily molded, (3) the representation defines a group in relation to other groups or in opposition to them, and (4) the representation serves primarily to explain the world or to shape group member behavior. The assertion that representations could conceivably exist at different points across each of these continua seems to be a relatively straight-forward, agreeable proposition.

III. How are Social Representations Created?

Historical, cultural, and social processes contribute to the generation of SR via two primary processes: anchoring and objectification (Deaux and Philogène 2001, Moscovici 2001a,

Wagner and Hayes 2005). Both processes make the unfamiliar familiar. Anchoring occurs when a community is exposed to a novel concept, process, or object (e.g., shale gas development). I write "community", and not "members of a community", because SR theory postulates that anchoring occurs primarily at the societal level, via shared social understandings. Through public discourse, the item is linked (anchored) to other concepts, processes, or objects already well understood in the community, which the community considers to be similar or related to the novel item. In this sense, the representation is truly a "re-presentation", a presentation once again, but in a modified form, of both the scientific physical reality that is the object/process, as well as of the previously held representations of similar objects/processes that the public integrated with the new knowledge (Moscovici 2001a). After social processes and shared social memory facilitate anchoring, society and its members internalize the relationships between the anchor and the novel idea, process, or object. Of course, the degree of internalization across individuals can vary.

The process of anchoring in SR theory is similar to the anchoring and adjustment heuristic, as detailed in psychological literature on heuristic processing (e.g., Gilovich *et al.* 2002), except that the anchoring in SR theory occurs primarily via social influences and processes (as opposed to almost exclusively individual ones) – due to communal discourse, social structure, institutional actions, and a shared history and culture. Moscovici (1984a, 32) points to some of the problems that can emerge from societies representing new information heuristically when he asserts that anchoring prioritizes "the verdict over the trial" and can lead to over-hasty decisions. SR are a means for simplifying the complex and necessarily leave out important information. Nevertheless, SR theory is not prescriptive (suggesting that SR should develop in a certain way), it merely efforts to describe the ways in which they develop.

Once the anchor has been set, objectification – the materialization or reification of abstract thinking – typically occurs. I write "typically", because for some objects or processes, such as some religious and spiritual phenomena, the opposite process may occur – trancendentalization (i.e., the material is made abstract rather than vice versa) (Billig 1993).

Nevertheless, in cases of complex scientific phenomena being transformed into common sense knowledge, objectification applies. Objectification occurs when a community associates images and descriptive language with the object of the SR. Alternately, some scholars refer to this process as nominalization – the treatment of actions or processes in terms of nouns (e.g., unconventional extraction of shale gas becomes "fracking") (McKinlay *et al.* 1993).

Anchoring and objectification access readily available and seemingly related historical, cultural, and social processes, concepts, objects, and structures to explain something new and make it familiar, thus producing a SR. While various influences ultimately contribute to social representations, anchoring and objectification can only occur in the presence of communication and discourse. Moscovici (1984a, 950) highlights the import of communication to SR when he explains that "representations are the outcome of an unceasing babble and a permanent dialogue between individuals."

The creation of SR is a communicative act; through public exchanges anchors are identified and language for objectification emerges. Doise (1993) distinguishes amongst three types of communication that allow for production of SR: (1) diffusion – where people simply pass on information they have received, (2) propagation – where people intentionally "aim to accommodate contents of other doctrines to their own well-established system" (159), and (3) propaganda – where the goal is to indoctrinate others in what is "true" and what is "false". One process can dominate in production of SR, or all three can operate simultaneously via different channels.

IV. Background on Social Representations Theory

Serge Moscovici is widely recognized as the father of social representations; Émile Durkheim could be seen as the theory's grandfather. Moscovici relied heavily on Durkheim's concept of collective representations. Moscovici (1988) describes at length his indebtedness to Durkheim, as well as the ways in which his theory deviates noticeably from Durkheim's.

A. Durkheim's collective representations

Durkheim never explicitly defined collective representations (Pickering 2000). This initially seems odd when one considers their massive importance to his characterization of social phenomena and to his approach to sociological investigation. Indeed, Stedman-Jones (2000, 37) emphasizes, "Durkheim insisted over and over again not only that representation is the crucial epistemological point by which social reality can be accessed, but that the very reality of society consists in collective representations." Pickering (2000) asserts that Durkheim never offered a definition for his key construct because the meaning of this word would have been obvious to academics and anyone well-read in his time.

Durkheim began his career as a philosopher, greatly valued philosophy, and read heavily from philosophical texts. In philosophy, representations date at least to Immanuel Kant (1724-1804). Kant's *Critique of Pure Reason* argues for the centrality of representations in science and reality (Pickering 2000). Kant's assertion that people represent the world around them, rather than reflecting the world in its exact physical manifestation, is an argument against empiricism. Durkheim, however, with his assiduous commitment to the scientific method, embraced empirical inquiry as a way to examine and categorize representations. In this manner, Durkheim followed Charles Renouvier (1815-1900), another philosopher deeply concerned with representations. Renouvier further departed from Kant in asserting that representations are created in society as opposed to within individuals' minds. Durkheim followed this belief; "for Kant representations are what the mind, as a set of faculties, produces. For Durkheim, the mind itself is a set of representations" (Stedman-Jones 2000, 49).

For Durkheim, the mind creates individual representations, but these are of minor importance compared to the collective representations that form through communication in social contexts and that exist as entities unto themselves. Durkheim (1901/1982, 39) asserts, "…specific facts reside in the society itself that produces them and not in its parts – namely its members. In this sense therefore they lie outside the consciousness of individuals as such, in the

same way as the distinctive features of life lie outside the chemical substances that make up a living organism."

Durkheim built off Kant and Renouvier to offer representations as a key contribution to the sociology of knowledge. While Durkheim discusses many types of representations in his writing, his primary distinction is between collective representations and individual representations. Collective representations are generated socially and exist independent of the thoughts of any individual. Individual representations are "ways of mentally dealing with experience, but which are unique to the individual" (Pickering 2000, 14). Therefore, the difference between collective and social representations extends beyond simply the level at which the representation is held.

Individual and collective representations refer to distinct concepts, not simply different numbers of people. In the preface to the second edition of his *Les règles de la méthode sociologique*, Durkheim writes, "But the states of the collective consciousness are of a different nature from the states of the individual consciousness; they are representations of another kind" (1901/1982, 40). He goes on to contend, "Myths, popular legends, religious conceptions of every kind, moral beliefs, etc., express a different reality from individual reality" (41). Individual representations are imperfect versions of collective representations; they occur within individual minds, but must be expressed through communication in terms of the collective representations that exist within society (Pickering 2000).

Durkheim not only argues that collective and individual representations are fundamentally different, but also that collective representations are central to understanding society, whereas individual representations are peripheral. He viewed collective representations as societal *knowledge*, whereas individual representations were merely *opinions* (Durkheim 1898). Pickering (2000, 16) explains, "Opinion, which constitutes individual representations, carries no weight [for Durkheim] compared with that knowledge which is mediated by society."

Some of Durkheim's adamancy on the strength of collective representations, and his rejection of psychological bases for collective representations, was presumably due to his goal of

establishing sociology as a field in its own right (Némedi 2000). Indeed, Moscovici recognized this when adapting collective representations to create social representations. Speaking to Durkheim's strict split between individual and collection representations, Moscovici writes, "This separation may have been unavoidable to affirm the autonomy of the new social science" (1988, 218).

B. Linking collective representations and social representations

Collective representations, for Durkheim, powerfully shaped social action. Because he believed that collective representations are held in common throughout an entire society, his collective representations are quite similar to Moscovici's hegemonic social representations. Moscovici writes that hegemonic representations "prevail implicitly in all symbolic or affective practices. They seem to be uniform and coercive. They reflect the homogeneity and stability that French sociologists had in mind when they called these representations collective" (1988, 221). Moscovici highlights three central aspects of the collective representation in his quote; they are: uniform, coercive, and stable. Durkheim asserted that collective representations strongly bound society together and could force people to act in unpleasant ways, due to their desire to maintain social order (Durkheim 1898).

It may seem odd to his readers today that Durkheim insisted so passionately that representations emerging from social discourse are universally-held and very slow to change. This does not seem to fit with our own observations of the world in the 21st Century. While Durkheim acknowledged the ability of collective representations to change when entering into dialogue with other collective representations, he equated the speed of this change to the evolution of language (Pickering 2000). Perhaps his assertions derive from the contexts in which he collected much of his data, such as preliterate societies (e.g., the aboriginal Australians in his *Les Formes élémentaires de la vie religieuse*). Moscovici, however, rightly points out that while Durkheim's collective representations paint an image of "upholders of an unfallible doctrine

around which a unanimous consensus prevails", "this view does not match or no longer matches the historical reality with which we are familiar" (1988, 219).

SR do not require everyone in a population to hold the same belief. Social representations create common points of reference, not consensual agreement (Clémence 2001). Philogène (2001, 40) clarifies this point; "Individuals may still have very divergent views concerning any given object, but their differences are structured around shared representations of that object." Doise *et al.* (1993, 4) explain, "More than consensual beliefs, social representations are therefore organizing principles varied in nature, which do not necessarily consist of shared beliefs, as they may result in different or even opposed positions taken by individuals in relation to common reference points." Part of the difference between Durkheim's hegemonic vision of collective representations and Moscovici's more nuanced vision of a variety of social representations may lie in the contrasting objects these two men studied. Durkheim focused heavily on religious objects; he is known for consistently maintaining that all science was born of religion. Even though he considered science the more refined and enlightened form of knowledge, Durkheim asserted that moral representations are required in society, whereas scientific representations are optional (Pickering 2000). That is, moral representations are the truly collective constructs that pervade society and are essential for its maintenance; scientific representations are simply descriptions unessential to upholding a working order in society.

Durkheim dealt more frequently with moral representations, whereas Moscovici explicitly sought to examine complex, novel, scientific phenomena. Nonetheless, Moscovici retains a connection to Durkheim's study of religious representations when he writes, "Social representations (are) a set of concepts and explanations originating in daily life in the course of inter-individual communications. They are the equivalent, in our society, of the myths and belief systems in traditional societies; they might even be said to be the contemporary version of common sense" (1981, 181).

Despite the differences between Durkheim's collective representations and SR, similarities abound. Both types of representations rely heavily on "apriorism"; a range of past

experiences, social understandings, and historical trends shape current thoughts and behavior. In *Les Formes élémentaires de la vie religieuse*, Durkheim explains, "Collective representations are the product of a vast cooperative effort that extends not only through space but over time; their creation has involved a multitude of different minds associating, mingling, combining their ideas and feelings—the accumulation of generations of experience and knowledge" (1912/2001, 18). Perhaps the most important concordance between Durkheim's collective representations and SR is that both reject Kant's assertion that representations derive primarily from the minds of individuals. While a range of factors, including individual thoughts, can shape both types of representations, the representations are only generated in the act of communication.

When comparing the fathers of collective representations and social representations, it is worth noting that they both wrote primarily in French. Therefore, another important similarity between the two types of representations is that, irrespective of whether "collective" or "social", they are both *représentations*. While the French word is a direct cognate for "representation" in English, the true meaning in French refers to an exacting effort to portray a given phenomenon accurately (Pickering 2000). The English "representation" means more broadly, "something which stands for or denotes another symbolically; an image, symbol, a sign" (*Oxford English Dictionary* 2014); the exactitude of likeness that the representation depicts is of less consequence in English. When reading the phrase "social representations" in English, the reader should effort to conceive of the French meaning to the word – an accurate portrayal rather than merely a symbol, image, or sign.

Moscovici and his followers have sought to modify Durkheim's concept for application in the mid-late 20th and 21st centuries. Now that sociology is a widely recognized field in its own right, the same need to build walls between individual and social influences on representations can be relaxed. Importantly, after being developed via public discourse, SR can be held by individuals, whereas individual representations could only ever approximate collective representations. SR also make sense in an increasingly self-reflexive world (Beck 1999). Whereas Durkheim saw the purpose of collective representations as maintaining social order,

and viewed adherence to these representations as evidence of a motivation to conform, SR theorists see SR as satisfying an innate human desire to make the unfamiliar familiar (Moscovici 1984b). Social representations, compared to collective representations, give increased agency to the individual. While SR are still constrained by *a priori* factors, individuals may vary in their fervor to familiarize themselves with new objects, ideas, and processes – potentially accessing distinct forms of communication due to differing levels of information seeking.

Having discussed the historical legacy on which SR theory builds, I now turn to other, more contemporary, theories that relate closely to SR.

V. Theories Related to Social Representations Theory

The obvious parent for SR theory is Durkheim's collective representations; yet, some scholars argue that George Herbert Mead's (1934) views on the relationship between society, the self, and the mind also played a role in SR theory's development (Fulkerson 2006). Mead shared with Durkheim the belief that "the communicative act is the basic unit of analysis" for understanding social phenomena (Farr 1996, 123) and that the mind exists primarily through society. Mead also viewed language as the key to human self-reflexivity, sharing with SR theory the belief that such communication can permit one to "become self-conscious rather than merely being conscious" (Farr 1996, 79). Mead's conception of the Self draws Durkheim's sociological conceptions into the realm of social psychology by affording greater perceptive capacity to the individual.

A. Symbolic interactionism

Herbert Blumer's (1969) symbolic interactionism, which grew out of Mead's thoughts about society, self, and mind, parallels SR theory closely. While both theories focus on the emergence of meaning about quotidian phenomena through social interaction, symbolic interactionism suggests a more fluid process by which meanings can change (Marshall 1998). Whereas SR are more subject to evolution than collective representations, meanings in symbolic

interactionism are less stable and fixed than SR. The greater focus on historical background and *a priori* cultural and social values and experiences in shaping SR led me to prefer this characterization of the ways in which people make sense of the world around them.

B. Framing theory

Another theory that parallels SR theory in some ways, but that is even more psychological (i.e., focused on individual level processes) than symbolic interactionism, is framing theory. While Entman (1993, 51) asserted, "nowhere is there a general statement of framing theory that shows exactly how frames become embedded", Scheufele (1999) attempts to clarify this vague theory by enumerating the processes by which framing occurs. Framing theory is closely tied to media effects theory and postulates that, "Mass media actively set the frames of reference that readers use to interpret and discuss public events" (Scheufele 1999, 105). These frames are internalized by individuals via active processing (additional information seeking), reflective interrogation (thinking critically about mass media information and talking it over with others), and selective scanning (ignoring most information and only picking up on a few items that are perceived as most relevant). These individual frames that arise from media frames "can have a significant impact on perceiving, organizing, and interpreting incoming information and on drawing inferences from that information" (Scheufele 1999, 107).

SR theory differs from framing theory in the emphasis the latter places on individual processing. Whereas the creation of SR is thought to take place in the public sphere, through shared discourse, frames are developed in the minds of individuals. Nonetheless, framing theory has been seen as useful by sociologists for studying social movements and collective action (Benford and Snow 2000). In this sense, however, framing theory is more useful for understanding the effects arising from use of a particular frame than for understanding the emergence of a frame (representation); the latter is a primary purpose of SR theory.

C. Social exchange theory

Another more individual-level (as opposed to societal-level) theory that still parallels SR theory is social exchange theory. Cook (1991) explains that this theory endeavors to explain how social structures change based on exchange relations between individuals (behavioral choices made in interpersonal interactions). Cook (1991, 37), citing Homans's (1961) work, defends her choice to proceed from individual actions to social structure; "Institutionalized behavior patterns persist for a reason, not simply because they are enshrined in norms." She asserts that individual desires play a central role in production and maintenance of any norms that may then in turn predict or ritualize behavior. Structure arises as a solution to commonly held desires. Nevertheless, social exchange theory postulates, "exchange and power processes result in certain patterns of social interaction that are the stuff of social structure," indicating that while individual-level actions may assert primacy over societal-level ones, social interactions at least have their own emergent characteristics (Cook 1991, 41).

D. Ritual

The final area of theory I consider here that relates to SR is work on ritual. Appropriately, due to its relation to SR, Durkheim contributed much to the understanding of ritual following its first use as an academic concept in the mid-nineteenth century. Durkheim (1912/2001, 36) described rites/rituals as "fixed modes of action" governed by rules of conduct. Durkheim distinguished between sacred and profane matters, suggesting that rituals relate to the former. As definitions of ritual have evolved, most scholars have retained the distinction between the sacred and profane as an aspect of ritual, regardless of the secular or religious nature of the act or process (Bell 1997). Profane, in Durkheim's usage, is not the opposite end from "sacred" on a singular continuum; rather, it means quotidian, pedestrian, mundane, and lacking reference to a sacred symbol (Moore and Myerhoff 1977).

The sacred nature of rituals allows these acts and processes to share with society an orderly message about causality and reality that is not readily subject to contestation. In Lévi-

Strauss's conception of ritual, this message comes from the myths (content, verbal expression) associated with the ritual (form, nonverbal action) (Bell 1997). Political theorists more recently have built on this distinction to claim that ritual is a means for engaging myths to define public problems (Bennett 1980). If myths are content and verbal expressions that characterize a potentially contentious public issue, they could be seen as a type of SR. SR can take on the myth-like characteristic of not being subject to contest, particularly when they adopt a hegemonic form based on ethical values and normative judgments (Doise 1993); nevertheless, in this sense myths are closer to collective representations, or the hegemonic subset of SR, than of SR holistically.

A key function of ritual is to integrate a social group and, in doing so, to establish an "other" (Bell 1997, Moore and Myerhoff 1977). Moore and Myerhoff assert, "ceremony is a declaration against indeterminacy" (1977, 16). Lukes (1975) makes the connection between ritual and representations explicit when he describes the role of ritual in creating and reflecting both meaning and function in a society; "ritual should be seen as reinforcing, recreating and organizing *représentations collectives*…[ritual is] the internalization of particular political paradigms or *représentations collectives*, whose role in political life requires investigation." Mary Douglas (1970) further links the discourse-based concepts of collective/social representations with ritual, when she reminds us that "ritual is preeminently a form of communication." Ritual is also a means for bringing together "history and structure, past and present, meanings and needs" (Bell 1997, 83).

This brief introduction to ritual shows that ritual may be more relevant to collective representations than to SR in general. SR deal broadly with sacred *and* profane topics. Indeed, the distinction between sacred and profane is not nearly as relevant in SR theory. With respect to complex scientific phenomena, some people and communities incorporate sacred symbols into their representations while others do not. Despite not requiring sacredness as an essential component of representations, and not necessitating full agreement on a representation, SR can still benefit from the idea of ritual as a process. There are many fora for public discourse that

could be characterized as "fixed modes of action" governed by rules of conduct that allow emergence and reification of SR (e.g., town hall meetings, hearing by state agencies, public debates). These formalized structures for exchange, as well as less formal "interaction rituals" – which Erving Goffman (1967) defined as any situation in which "face" is put at stake – highlight some of the ways in which SR develop.

VI. SR as Sociological Social Psychology (and why this matters)

There are many nuanced ways in which SR theory departs from each of the aforementioned theories; yet, a key point of differentiation is the extent to which each theory presumes that social meanings and social knowledge derive from primarily societal-level versus individual-level factors. I now examine where SR theory falls on that continuum, and why this matters for research (and for my research in particular).

A century-old debate exists over the role of individual cognitions and individual agency in the emergence, maintenance, and updating of representations. Ever since Durkheim proposed collective representations, other scholars argued that the minimal focus on the individual was inappropriate. For example, Schmaus (2000) contends that Durkheim has mistakenly equated collective representations with social facts. Schmaus asserts that social facts can be acted upon and represented in different ways by various individuals; therefore, the conceptualization of collective representations is wrong because social facts should not be thought of as universally-held. Jahoda (1988, 198) wages a slightly different critique on SR, arguing that different manifestations of the theory allow for individual-level influences of different weight, producing a "crassly contradictory" set of statements.

A. SR as social psychology

The long debate about the roles that individuals versus society play in creating representations places these concepts in the realm of social psychology, but *where* within social psychology is less certain. Social psychology is a broad term characterizing empirical research

and theory "about how people respond to social influence, about group dynamics and intergroup relations, and about social thought" (Goethals 2003, 18); yet, it is too expansive and is composed of too many opposing forms to lend itself to an easy definition. While social psychology is populated with a number of minor theories that "deal with only limited parts of the field's subject-matter and have little or no explicit relationship to one another" (Cartwright 1997, 14), a major bifurcation has been identified that can help structure the field: psychological vs. sociological social psychology. The psychological version is far more common in North America and the sociological form dominates in Europe.

Where a theory of social representations falls within the realm of social psychology is not a trivial question. Remembering Einstein's words that started this chapter, "It is theory that decides what can be observed." Social psychologists of different persuasions seek fundamentally different data. In psychological social psychology, individuals are studied in their social context (although some ostensible social psychological research seems to ignore the social context altogether, examining individuals in no context at all). Even in ideal psychological social psychology, therefore, society is treated primarily as the setting in which already-formed individuals find themselves. In the sociological variety, society and culture are viewed as pre-existent entities that fundamentally shape individuals.

Floyd Allport is often seen as initiating psychological social psychology, while Durkheim is frequently credited with initiating the sociological form (Cartwright 1997). Durkheim, himself, however, would have likely eschewed the term "social psychology" for his work. He wrote, "Social psychology, whose task it should be to determine [representations] is hardly more than a term which covers all kinds of general questions, various and imprecise, without any defined object" (1901/1982, 41). He advocated his own more precise "sociological" method.

B. SR as sociological

Due to its lineage from Durkheim and its use primarily within Europe, it is no surprise that Social Representations Theory is typically classified within sociological social psychology

(Goethals 2003). Farr (1996) explains that SR research contrasts with the psychological social psychology research on attitudes and opinions conducted primarily in America; yet, he offers that this is one of the few areas in social psychology where a meaningful reconciliation between the two variants has at least been attempted. Farr (1996, 129) claims, "In many ways, it [social representations theory] comprises the antidote to the process of the individualization of social psychology in America."

I selected SR theory for my dissertation in part due to its recognition that social structures are more than background noise that should be accounted for marginally while studying individuals. While some scholars may contend that SR theory goes too far in the other, sociological, direction, I disagree. I actually view Jahoda's (1988) foregoing critique of SR theory – that it seems to waffle back and forth between assuming different levels of individual agency, from "group mind" to allowance for self-reflexivity – as a strength of the theory. SR theory is explicit that a much larger role should be afforded to social structures and processes in the generation of beliefs and knowledge (i.e., representations) than is afforded in American social psychology; it is also clear that the influence of social structures and processes is less (in most cases) than in Durkheim's deterministic collective representations. Exactly where on the continuum between those two poles SR theory lies is not always transparent. This is because different types of social representations vary in the degree to which they are shared and easily molded; therefore, they can command contrasting levels of individual and societal influence.

One of the reasons Durkheim's collective representations needed updating was because they were too restrictive. They were not holistically wrong; many moral and religious phenomena can still be described with Durkheim's ideas. His conception, however, is not comprehensive enough to be the foundational concept and object of study for a theory that seeks broadly to explain how beliefs, meanings, and knowledge develop in society. The sociological foundation, but flexibility of SR theory makes it more capable of accomplishing such a feat.

The sociological social psychology of SR theory is a strong and welcome critique of the Cartesian (i.e., *cogito ergo sum*) approach to social psychology that emerged in the USA during

and following World War II. Individual thought monopolized the focus of social psychological research, and to some extent still does, in the States. In 1968, Gordon Allport famously defined social psychology as "an attempt to understand and explain how the thoughts, feelings, and behavior of individuals are influenced by the actual, imagined, or implied presence of others" (3). Such an extremely psychological approach might be explained away in the couple decades following the war, considering that the field of social psychology experienced a major transformation only a generation earlier (Cartwright 1997, Farr 1996). Nevertheless, when I read that same definition for social psychology in the glossary of a 2005 textbook titled "Social Psychology", I was surprised and disappointed (Aronson *et al*. 2005).

All thoughts are, in some way, conditioned by the "actual, imagined, or implied presence of others"; therefore, there is little to distinguish Allport's social psychology from mainstream psychology. This definition is too cognitive to characterize *social* psychology; if an individual's thoughts feelings and behaviors can be understood by examining only the imagined or implied presence of others, this assumes that the cognitive faculties of the individual are all that matters. The real ways in which society shapes individuals are underplayed severely. The field of social psychology, particularly in the USA, still has a long way to go in terms of recognizing the value of sociological approaches to social psychological research.

C. SR as a way to examine social and individual-level processes

A virtue of a flexible sociological social psychology theory like SR theory is that it can be used to observe, measure, and analyze phenomena at the societal/collective and individual levels. These levels have also been labeled as "macro-sociological" and "micro-sociological" processes (Huber 1991b). Zelditch (1991) points out that the question of which level to study and to attribute causal primacy to is central to the work of almost every sociologist. This question is equally, if not more essential, for social psychologists, who have the explicit goal of studying the individual and the social.

The nature of one's ontological commitment about whether societal processes affect individual processes and/or vice versa can play a major role in the questions a researcher asks, the methods he employs, and the data he collects (again, see Einstein). Huber (1991a, 6) suggests that the directionality of these influences point us to asking one of two essential questions: "Under what conditions do individuals affect the societies in which they live?" or "Under what conditions do societies affect individual destinies?" While these questions imply a neat causal progression from individual action and thought to societal structure, and vice versa, Huber (1991a, 6) reminds us of a sobering reality: "common sense and research make all of us aware that everything interacts with everything else."

C. Wright Mills understood the iterative and reciprocal interactions between society and individual when he conceived of his sociological imagination. Mills (1959, 6) contends,

> We have come to know that every individual lives, from one generation to the next, in some society; that he lives out a biography, and lives it out within some historical sequence. By the fact of this living, he contributes, however minutely, to the shaping of this society and to the course of its history, even as he is made by society and by its historical push and shove.

Indeed, while some social psychologists do adhere to extreme positions on either end of the continuum, adopting positions of radical social-level determinism or radical individual-level determinism, many fall in between, recognizing that while causality may move primarily in one direction, there will always be feedbacks for which to account (Cook 1991). Social representations theory attempts to achieve a balance in this respect.

Hechter (1991) takes the individual-social distinction a step further by raising the question of how historical developments can affect our understanding of causal primacy at the individual or social level. He explains that some psychologically-inclined theorists will say that individual-level desires for money, power, and prestige shape social structure, but he questions how this can support an individual-level theory when he asserts that the constructed natures of money, power, and prestige are themselves products of social structure. Hechter's thoughts are a good argument for including historical, social, and cultural *a priori* factors when examining SR.

Mills helps us conceive of how to use realizations such as Hechter's to inform our research questions. He writes, "No social study that does not come back to the problems of biography, of history and of their intersections within a society has completed its intellectual journey" (1959, 6). Mills (1959, 6-7) then offers a series of questions that, if investigated, can fulfill his mandate, including:

> (1) What is the structure of this particular society as a whole? What are its essential components, and how are they related to one another? How does it differ from other varieties of social order?
>
> (2) Where does this society stand in human history? What are the mechanics by which it is changing? What is its place within and its meaning for the development of humanity as a whole? … How does it differ from other periods?
>
> (3) What varieties of men and women now prevail in this society and in this period? And what varieties are coming to prevail? … What kinds of 'human nature' are revealed in the conduct and character we observe in this society in this period?

Social representation research allows and prompts the investigator to ask such questions. Many of these questions need to be answered if the researcher is to understand how and why representations were anchored and objectified in particular ways.

Despite the necessity of garnering a deep appreciation of social context, a strong stance on the dominance of individual-level or societal-level processes is likely misplaced. Across spatial and temporal contexts, individual behaviors shape social structures and vice versa, individuals mold the society and the society molds individuals. Calhoun (1991) acknowledges this relationship when we writes, "It is not adequate to conceive of a macrosociology entirely on micro-foundations or to conceive of microsociology as set within the context of macrostructure" (1991, 54). Calhoun evokes Giddens in his explanation of the joining of societal- and individual-level processes; Giddens (1985) sees intersubjective processes as primary to the individual *and*

society in his "structuration" hypothesis. Individuals and society are both considered products of the historical process. That is, repeated individual acts "reproduce" the social structure. As the social structure is reproduced, it can change incrementally through alteration or erosion of social norms. Giddens and Calhoun thus remind us that over time and on different spatial scales, societal and individual process can vary in their importance for explaining social phenomena.

VII. Relevance of SR Theory for Studying Shale Gas Development

Social representations theory holds promise for examining the full range of influences on thoughts about shale gas development because it explicitly accounts for both social and individual processes. Zelditch (1991) suggests that social psychological theories that link structure to action (as SR theory does by linking *a priori* factors to communicative acts) can be particularly useful for establishing linkages between social and individual processes.

While all of the social psychological theories I reviewed above are useful for describing the processes by which shared meanings evolve in society, and the means by which (and degree to which) individuals participate in the creation of those meanings, SR theory uniquely asserts that the purpose of these meanings is to make the unfamiliar familiar. It alone focuses on understanding the mechanisms by which novel, complex, often scientific object/processes transform into the common sense Creole of the man on the street. Once an object, process, or idea has been made familiar, its representations can continue to evolve, but via a different process. New objectifications of the object can arise, but shifting a weighed anchor can be more difficult than weighing that anchor initially. One reason I selected SR theory to guide my research is that by understanding the content of SR, the processes by which they emerge, and the degree to which a community agrees upon a shared representation, one can begin to comprehend why the members of that community may choose to welcome, support, fight, or regulate the object of the representations (e.g., shale gas development).

A virtue of SR theory is that while it approaches social phenomena from a sociological social psychology perspective, it does so reservedly. New social representations are built off

previous ones (which reflect social structure), but individual actors also shape and reshape the representation through their actions. Moscovici (2001a, 63) contends that a representation, and the concepts and processes it reflects, "is art, not raw material; it is created, formed and fashioned before, during, and after our attentive observation." It is particularly fruitful to study social representations in times of crisis and upheaval because this is when the art is molded most quickly; this is when new representations emerge. Wagner and Hayes (2005, 324) observe, "In most cases, representational work and collective symbolic coping will be initiated by social conflict."

The connection between SR and social conflict helped me alight upon this theory for studying public perceptions of and discourse about shale gas development. The processes attending shale gas development are novel, introducing large amounts of new information into populations (much of which must be translated from complex science into common sense); additionally, the processes and effects of shale gas development often foster a dissentious social discourse. Shale gas development is discussed in a variety of public fora, including: mass media coverage (newspaper, radio, and television, at local, state, and national levels), community group meetings, public meetings held by regulatory agencies, social media (e.g., Facebook, Twitter), advertisements from Industry, messages from environmental groups, protests and demonstrations, letters to the editor, and, of course, the informal conversations in diners, shops, coffee counters, at gas stations, and on the street. Even signs on front lawns, billboards, and bumper stickers on cars carry on the conversation and representation of gas development. Social representations theory does not limit itself in the fora it looks to for evidence of representations.

The types, content, and frequency of public discourse and communication on a topic powerfully influence the structure of the SR that emerge from the production process (Marková 2003). Therefore, beyond examining a range of discourse types, SR theorists advocate investigating a spectrum of components that comprise representational content. Abric (2001, 43) catalogues the components essential to formation of any SR; "The central core [the elements that give a representation its meaning] is determined by the nature of the object represented, by the

type of relations that the group maintains with this object, and, finally, also by the system of values and social norms that constitutes the ideological environment of … the group".

Abric lists "the nature of the object" as the first factor shaping representations. Therefore, SR theory would contend that the processes related to shale gas development, their effects on the landscape and communities, and the extent to which the processes and their effects are observable will forcefully frame SR. The variation in the extent of development and observable effects of development across the landscape, therefore, could lead to variation in SR of shale gas development across communities. That SR theory provides a way to meaningfully account for differences in development makes the theory useful for studying shale gas.

Abric's reference to "the type of relations that the group maintains with this object" refers to relationships such as: opportunity to lease for shale gas or not, presence of signs supporting or opposing development, participation in protest or support rallies, existence of and attendance at public meetings, existence of groups focused on this issue, circulation of petitions about shale gas, etc. SR, however, are shaped by much more than just the current relationships to the representational object; they are also based on past relationships with similar objects – the *a priori* experiences. History of conventional natural gas and oil development in the area, and even other forms of resources extraction such as coal mining and timber harvesting, are presumably relevant. These experiences could have contributed to structures in the community that make new development seem more or less familiar and more or less acceptable. This incipient list of factors begins to highlight the value of SR theory for characterizing social knowledge about shale gas development in a way that could be useful for policy, governance, and communication.

Finally, Abric offers "values and social norms" as key elements that give meaning to SR. Myriad values and norms sculpt SR. One important distinction here is between "values" in the sense of things that people deem worthy due to their usefulness or desirability (e.g., good quality roads, low crime rates, a strong economy), and "values" as commitments that people hold as moral/ethical considerations (e.g., economic equity in a community, the ability for citizens to

participate in decision making processes, the ability of landowners to use their property as they see fit). Both types of values are potentially relevant to the creations of SR; both types need to be explored to understand representations well (Doise 2001, Moscovici 2001b). The inclusion of such a range of values as important for creation of SR makes this theory appealing for my dissertation research.

VIII. Social Representations Theory as the Guiding Framework for this Dissertation

The foregoing section reveals that SR theory can be used to study a panoply of societal- and individual-level factors that form knowledge, beliefs, and meanings about shale gas development. SR theory accounts for the sociological deficiencies in many other social psychological theories commonly used in the USA – it recognizes that social structure, history, and shared values are more than minor background variables. SR theory does not reduce society to one influence (of many) on cognitions. SR theory is particularly useful for investigating beliefs and knowledge about relatively novel and unfamiliar objects and processes. Finally, we have seen that SR theory is most useful when the phenomena being analyzed are contentious and breed social conflict. Einstein's question remains, will this theory be useful for my practical goals related to informing policy development and communication on this issue?

I believe it will. Of course, to be useful, the theory need not only be sound, but the theory must be able to be used to generate useful empirical data – I address this issue in Chapter Three. To design useful policy, governance strategies, or communication approaches, one first needs to know why people (i.e., the citizens affected by policy and the audiences for the risk communication) think about and discuss shale gas development as they do. SR theory is one of the most comprehensive and nuanced theories for examining such a question. Despite its sophisticated approached to social psychological inquiry, I make one alteration to SR theory when I apply it to my dissertation – I do not *assume* that social representations exist. Even though I agree with the postulates in SR theory and find the theory convincing overall, I believe it is better to exercise some skepticism as to whether all of a chosen theory's assumptions should

be taken as Gospel. Theories are valuable for two primary reasons: (1) they bring order to our conceptions of the world by explaining how the world works *and* (2) they provide a way for us to meaningfully investigate certain types of phenomena. To assume that SR exist is beneficial for SR theory to achieve the former goal, but it is potentially detrimental to the latter project.

If one were not to assume that SR exist, but instead were to approach his research with the goals and perspectives of SR theory, while critically examining the extent to which SR exist, he would produce a valuable characterization of social knowledge about shale gas development irrespective of the representations' actual presence in the community. I seek to use SR theory primarily to provide better ways to investigate phenomena. In doing so, I provide a useful validation of the extent to which SR theory succeeds in explaining how the world works. Fundamentally, SR theory offers me an approach for studying social knowledge about shale gas development. In the next chapter, I illustrate that approach in detail.

Chapter Three: Methodology and Methods

"You know my method. It is founded upon the observation of trifles."[3]
-- Sherlock Holmes, via Sir Arthur Conan Doyle, *The Boscombe Valley Mystery*

I. An Approach to Studying Social Representations

Social representations research demands a Holmesian methodology in the sense that the same story needs to be analyzed from multiple angles. Social representations researchers often study the emergence and evolution of representations through triangulation of several methods (Doise *et al.* 1993).

Social representations (SR) are amenable to change – more amendable than collective representations, for example. The incremental transformation of SR suggests that even sophisticated measurement of the representations individuals hold at a single point in time is insufficient to characterize these phenomena; one must also know how and why the representations form. To discern the extent to which public characterizations of an issue are *social* representations, one must garner some understanding of the long-term history in a region, cultural values, and social structures that fostered the emergence of those representations. If a researcher cannot detect the degree to which SR are grounded in that context), one might question whether SR theory offers an adequate explanation for characterizing discourse on that issue. A goal of my research is not only to describe SR, but also, more critically, to evaluate the adequacy of SR theory for explaining emergence of beliefs about shale gas development.

A solid methodological approach to studying SR not only characterizes representations, but it also investigates the emergence of those representations – across social structural, cultural, historical, and geographic contexts. SR theory hypothesizes that representations develop through a shared public discourse in which people can meaningfully engage. If representations are consistent across a broad range of social/cultural arrangements and geographic scales, this sheds

[3] Read in context, Holmes' "observation of trifles" refers to meticulous attention to even the smallest details.

doubt on the import of local and regional context in fostering representations. Alternatively, differences in SR across communities, which can be linked to specific variations in context, offer support for SR theory and help enumerate the factors that influence SR.

Finally, data should be collected at and compared across different levels of analysis if the researcher seeks to rigorously investigate SR. Social representations theory postulates that individuals and social processes contribute to development of representations. Individuals internalize representations that emerge through public discourse. Therefore, a holistic characterization of SR would need to examine individuals' representations of an issue as well as community-level evidence of public discourse on that issue within those individuals' communities.

The foregoing methodological requirements for studying SR do not equate to a requisite set of methods for conducting data collection and analysis; they do, however, reveal the value in using a range of methods that can achieve various goals. In the remainder of this chapter, I first continue my discussion of methodology by reviewing methodological literature on SR research. I highlight the most common methods employed and why they are useful. I then provide examples of how contemporary researchers have investigated SR.

Second, I introduce the reader to the study areas (i.e., geographic locations) in which I conducted my research. Because SR and the ways in which they emerge are, to an extent, context specific, I describe the contexts in which I studied representations of shale gas development, and I discuss why I selected these particular contexts for my research. Finally, I detail the methods used in each stage of my research.

II. Methodology of Social Representations Research

I use "methodology" to describe one's overarching approach to conducting research. More than simply an amalgamation of methods, a researcher's methodology is his rationale for conceptualizing, designing, and carrying out his research as he does. The *Oxford English*

Dictionary offers this definition for methodology: "the study of the direction and implications of empirical research, or of the suitability of the techniques employed in it".

Breakwell and Canter (1993, 6) identify a dilemma in empirical research on SR; "There are no clear criteria which, once satisfied, ensure that social representations have been catalogued. This has left researchers feeling continually at risk of rebuttal." No single approach allows the researcher to capture definitively the representations of an issue and the pathways by which they emerge. Breakwell and Canter's methodological solution, and the resolution adopted by many other SR researchers, is to thoughtfully integrate a range of approaches to examining SR in a natural context (Doise 1993, Doise *et al.* 1993, Farr 1993, Uzzell and Blud 1993, Wagner and Hayes 2005). Approaches can vary by the level at which the data is collected, the means of data collection, and the perspective from which the data originates.

The most commonly used means for studying SR have been questionnaires, individual and group interviews (often including free word associations or image elicitations), and media content analyses (Breakwell and Canter 1993). I built off the strong tradition of multi-method SR research by conducting my investigation in three stages: (1) content analysis of newspaper coverage on shale gas development, (2) in-depth interviews and other exploratory qualitative work in a range of communities, and (3) design and administration of a quantitative instrument based on the initial qualitative work.

Even though SR reflect discourse and processes at the community/group level, they are held by individuals and can thus be measured in part on the individual level, by evaluating the range of perspectives held and analyzing the level of intersubjective agreement between them. Breakwell (1993) emphasizes the need to collect information from aggregates (e.g., community level) *and* individuals to capture both the diversity of attributes for shared representations as well as overall agreement on the representations. Farr (1993) further notes that in addition to collecting data at different levels of analysis, it is valuable to obtain both non-reactive (e.g., media content analysis and other secondary data collection) and reactive data (e.g., interviews and questionnaires), because each type has different sources of error.

By starting research on social representations with content analyses of mass media coverage, the investigator can begin to identify, at the societal level, the range of SR that exist and the community attributes conditioning their emergence. These findings can be verified and expanded upon through observation of public rituals (e.g., community meetings, protests, and public forums) and physical artefacts within study areas (e.g., signs, posters, meeting minutes, presence of development across the landscape) (Bell 1997, Goffman 1967). Interviews with residents engaged in shaping or facilitating discourse on shale gas development (e.g., through advocacy or creating fora for conversation) can help reveal community attributes, as well as individual traits, that affect SR (Doise *et al.* 1993, Wagner and Hayes 2005). During interviews, SR researchers commonly use semi-structured questioning as well as free word associations, which are a useful means of determining the words, images, knowledge, and ideas that characterize social representations within a population (Clémence 2001, Doise 2001, Doise *et al.* 1993).

Quantitative surveys are also used in SR research (Breakwell and Cantor 1993). Surveys provide a direct means for examining differences in representations across geographical contexts. To design surveys, however, (at least ones with close-ended questions) the researcher must be aware of the types of representations that potentially exist in his study areas, the factors that shape representations in those areas, and the ways in which representations vary between study areas. Therefore, initial qualitative work can effectively form a contextual baseline from which a researcher can design an effective quantitative survey.

A. Recent research in social representations

While the methodological literature on SR research extols the virtues of triangulation and multi-method inquiry, in practice, the range of methods employed in individual empirical studies of SR tends to be more limited. I surveyed articles mentioning the words "social representations" in major academic search engines (i.e., Web of Science, Google Scholar), and focusing on empirical research, to garner an understanding of the methods most commonly

employed in contemporary investigations of SR. I searched for articles published from 2010-2014. While my review reveals that a number of methods are used across studies, relatively few researchers triangulated methods within a single study.

1. Approaches to studying SR

My review revealed five main categories of methods used to study SR: interviews, surveys, word associations, content analyses, and a combination of these methods. Studies that examined SR entirely through interviews included an examination of SR of bullying in schools through interviews with students (Thornberg 2010), analysis of SR of landscape change in the French Alps through interviews with residents and visitors (Quétier *et al.* 2010), and investigation of the nature and means for production of SR of climate change through focus group interviews (Wibeck 2014).

An example of SR research using solely interviews that still addressed aspects of the complex context specificity of SR is Selge and Fischer's (2011) investigation into the SR of "invasive species". They conducted focus group interviews, which they complemented with a few interviews with individual key informants. Each focus group they conducted brought together a different segment of society with potentially different representations of "invasive species": members of the general public, conservation volunteers, and scientists. Catalán-Vázquez and colleagues (2014) also employed a sophisticated sampling strategy in their research on SR of risks due to manganese exposure in Mexican mining communities. They began by conducting multiple individual interviews in each of six communities. As additional residents in the communities learned of the study, some requested to become involved, which led to further interviewees via snowball sampling. The researchers were careful to include residents, public officials, and an industry representative in their sample.

In all studies I reviewed that included interviews as a means of examining SR, the interviews were semi-structured to unstructured, generally beginning with a few broad questions or simply seeking unprompted descriptions of the phenomenon of interest. These studies also

always employed qualitative, thematic coding, which allows researchers to identify common representations through an iterative process in which they categorize the SR mentioned most frequently as they review interview transcripts. In the studies that used focus group interviews, the researchers sought not only to study the nature of representations (and potentially the variation in representations across social groups), but also to observe the active emergence of representations. Because focus group interviews create social settings in which discourse occurs, information and views are shared among the focus group participants. Such conversation allows perspectives potentially to evolve during the course of the interview. These interviews present an opportunity to examine development of SR *in situ*.

SR research also regularly relies upon surveys and questionnaires. Studies that employed solely surveys to examine SR include: a survey of a random sample of Stockholm residents with four open-ended questions about their perceptions of causes of physical/mental health and illness (N=1240) (Åsbring 2012), an open-ended questionnaire mailed to Estonians and Russians about their perceptions of inter-ethnic issues in the Baltic States (N=76) (Kus *et al.* 2013), and an online survey of Austrians' perceptions of the 2008 economic crisis (N=153 laypersons and 156 employees of financial institutions) (Gangl *et al.* 2012). These examples show that survey samples can be randomly- or purposefully-selected, can be distributed and collected in multiple ways, and can target a single group or multiple groups across which SR could vary meaningfully. Gangl and colleagues' (2012) study matched the two samples on several key characteristics to justify comparison across groups.

Sample sizes for surveys in SR research vary considerably. Even surveys with large sample sizes in SR research (e.g., Åsbring 2012) commonly ask only open-ended questions – often to not constrain respondents in their representations of an object or process. Researchers use qualitative coding and statistical analyses of the resulting data (commonly correspondence factor analyses) to characterize the emergent SR.

A third approach to conducting SR research is content analyses. A number of approaches exists for analyzing content analytic data, including: (1) qualitative coding and thematic analysis

(of narratives written by young Africans about HIV testing) (Beres *et al.* 2013), (2) statistically-intensive lexical analysis (of newspapers articles about a conference on climate change, from a three week period across four French and four German national newspapers) (Caillaud *et al.* 2012), (3) semiotic analysis, that is, examining what is implied or signified by the written content (of academic, governmental, and non-governmental agency texts on tourism planning) (Moscardo 2011), and (4) identification of metaphors (Caillaud *et al.* 2012). Most authors who used content analyses mentioned that they favor this method because it captures information about social, as opposed to individual, processes. In most cases, content analyses review documents that themselves comprise public discourse. Therefore, rather than asking individuals to provide an interpretation of public discourse, the researchers examine the discourse itself. Some authors (e.g., Caillaud *et al.* 2012) also argue that few people have the opportunity to participate in discourse on major environmental/risk issues directly, and therefore, much of the general population relies heavily on mass media characterizations to develop SR of these issues.

The fourth approach to studying SR I identified was word associations. This method typically asks participants to share the first three to four words, phrases, or images that come to mind when they hear a specific word or phrase. Mouret and colleagues (2013) used this approach to examine differential SR of "wine" in France and New Zealand, with a further distinction between wine experts and non-experts in both nations. They followed the elicitation of word associations with qualitative coding to reveal major themes; they followed up with correspondence analyses. This analysis allowed them to use their categorical data (i.e., yes/no as to whether a theme was mentioned by each participant) to determine which themes related most strongly to each other. Mäkiniemi and colleagues (2011) used similar coding and statistical procedures to analyze word associations provided by university students about "ethical food".

Another type of word association is the Q-sort method – an approach to determining SR where participants are presented with a list and choose a certain number of items that they find most representative of the phenomenon of interest, and a certain number of items they find least representative (still leaving some items not selected for either category). Lo Monaco and

colleagues and Anderson and colleagues (2013) employ this approach. Items are given a value of +1, -1, or 0 based on whether the item was considered representative, not representative, or neither. This data can then be analyzed through an ANOVA, t-test, or correspondence analysis.

2. Multiple methods, single level of analysis

About 30 percent of the contemporary empirical studies of SR that I reviewed used multiple methods. Due to Breakwell and Cantor's (1993, 6) assertion that "There are no clear criteria which, once satisfied, ensure that social representations have been catalogued", and due to the theoretical postulate that SR are individually-held perceptions that emerge through social processes, it would seem that research using only one method likely fails to capture the complexity of the SR. Some research using multiple methods still only examines data from one level of analysis. For example, Smith and Joffe (2013) collected word associations on "climate change" from 56 readers of print media in the UK. They then followed up on these associations with in-depth interviews with the same 56 individuals.

Anderson and colleagues (2013) also used multiple methods (visual Q-sort, word associations, and interviews) to examine SR of approaches to land use, yet, all methods were employed with the same individuals. A third example of multi-method research that focuses on a single level of analysis is the interviews and questionnaires used by Joffe and O'Connor (2013) to examine SR of earthquakes in cities. This research, however, allows for a deeper investigation of SR than the previous two studies by including matched samples from Japan, Turkey, and the USA. Nevertheless, the most interesting studies I came across during my review were three investigations that demonstrated substantial methodological rigor by combining different forms of data collected across individual and societal levels.

3. Multiple methods, multiple levels of analysis

Mayor and colleagues (2013) examined SR of H1N1 influenza in French-speaking Switzerland by conducting three waves of interviews over an 18 month period with the same

individuals. They used thematic coding to analyze the data, which they then interpreted alongside media coverage for H1N1 in five major French-language Swiss newspapers over that same time frame. The longitudinal nature of this research along with the combination of content analytic and interview data indicate its methodological strength. In another example of robust methodology, O'Connor (2012) investigated SR of the economic recession in Ireland through semi-structured interviews with members of the public, one focus group interview, and an online survey.

A final example of methodologically rigorous SR research comes from Elcheroth and colleagues' (2011) work on SR of ethnic tensions in (former) Yugoslavia. They introduced a longitudinal component by analyzing multiple historical surveys (conducted by other researchers), which they used to design a mass media content analysis and their own survey. While the methodological literature on SR suggests that archival research can be important for understanding the cultural, social structural, and historical factors that shape SR, this was the only study I reviewed in which archival research, outside of content analyses, played a major role.

B. Lessons learned from recent SR research

My review of contemporary empirical research on social representations led me to several reflections that shaped the methods I used for my own data collection and analysis. First, each study seemed to proceed from the assumption that SR existed for the phenomenon under investigation. While SR theory is theoretically justified and has been verified empirically multiple times, the degree to which culture, social structure, and history produce social processes that lead to emergence of representations likely varies across issues. That is, for some issues (e.g., those that evoke substantial public discourse), SR are probably more *social* (i.e., emergent from collective as opposed to individual processes), than for other issues.

Perhaps an assured faith in SR theory led some researchers to not see a need to triangulate their findings through multiple forms of data collection and analysis. While I used

SR theory as a point of departure for my dissertation research, I sought not only to characterize SR of shale gas development, to explain how they emerge and evolve, and to determine how SR could affect policy and communication, but I also desired to discover the extent to which SR of shale gas development are actually *socially* produced. This led me to focus more on the factors contributing to SR, compared to many of the authors cited above.

My second reflection on the aforementioned research is that most SR researchers collect their data from a small sample size and from non-random samples. Both choices make sense for in-depth interviews, due to time and resource constraints, due to the desirability of selecting the specific individuals who can best comment on the object being represented, and due to the fact that reaching the point of saturation through thematic coding does not typically require huge samples. Nevertheless, the methodological literature on SR in the previous section reveals that surveys and questionnaires are an important component of fully understanding SR. The small sample sizes and convenience sampling approach in much SR research raise legitimate concerns over how transferable/generalizable the findings are. This is particularly disquieting when one considers the importance SR theory places on social, cultural, and historical context – characteristics that can vary markedly between communities. My apprehension about a deficiency of transferable findings in SR research led me to disseminate my survey to a larger and more stratified audience than in most SR studies.

My third observation is that the methodologically strongest studies often include comparisons across geographic areas and across differently-positioned social groups. They generate understanding of how widespread and/or context specific representations are. This helped inform my selection of a range of actors from myriad social groups for my interviews, and encouraged me to stratify my survey sample across two states and numerous municipalities in each state.

My fourth impression from the contemporary SR research is that even when quantitative data analysis occurs, it is often quantitative analysis of open-ended, qualitatively-coded data. Nothing is wrong with such analysis, per se, but it does present opportunities for additional

forms of data collection and analysis. SR researchers are often apprehensive about asking close-ended questions because they want the participants in their research to articulate their own representations (as opposed to giving participants options to choose from; although this does happen in the Q-sort methodology). Nonetheless, if close-ended questions were informed by rigorous characterization of SR through other methods in advance, they could be a powerful tool for confirming or rebutting, across a broader population, a researcher's initial determinations of SR, and for illuminating the *degree* to which SR are held (i.e., how strongly individuals and society hold a specific representation).

My fifth impression from the SR studies I reviewed is that while the breadth of methods for data collection is impressive, the approaches to data analysis seem underdeveloped, specifically for statistical data analysis. While a number of statistical methods have been offered for examining SR (e.g., see Doise *et al.* 1993), sophisticated statistical techniques are adopted infrequently. Additional analysis techniques would allow researchers to ask further questions of the data, such as an increased focus on why particular social representations exist. In light of this observation, I resolved to collect my data in a way that would allow for statistical analyses that have not yet been applied in SR research. Particularly, I sought to collect data that could be subjected to structural equation modeling (SEM). This method allows a researcher to combine factor analysis (commonly used for characterizing SR) with something akin to regression analysis; SEM, however, incorporates stronger causal assumptions than regressions do. SEM also allows one to confirm theoretical predictions about the factors that shape SR.

Having learned from the methodological literature on best practices for studying SR and from contemporary empirical research, I now introduce my own research approach.

III. Research Questions

I chose social representations theory as my theoretical framework for this research because I sought to understand how society and its members perceive shale gas development via hydraulic fracturing (i.e., characterization of SR) and why development is perceived as it is (i.e.,

which factors contribute to production of SR). I aimed to design research that could help residents achieve positive outcomes and limit negative consequences in light of shale gas development. I further endeavored to investigate this topic in a way that would allow me to offer recommendations on the policy process surrounding shale gas development.

Beyond the applied/practical goals of my research, I strove to design my inquiry in a way that could forward theoretical and methodological investigation of SR. From a theoretical standpoint, I wanted to examine critically the extent to which SR theory is useful for characterizing public perceptions of a contentious environmental/social issue. SR theory has been used rarely as a theoretical framework in the USA and it is only beginning to be used in Europe to study energy development (Batel and Devine-Wright 2014, Devine-Wright 2009, Devine-Wright and Howes 2010). By evaluating the assumptions of SR theory, rather than accepting them as a point for departure, and by testing these assumptions in relation to unconventional energy development in North America, I undertook an effort to explore the value of this theoretical approach in new contexts. I also sought to advance methodological rigor by introducing statistical techniques new to SR research and by offering a novel combination of methods for triangulation of data on SR.

The foregoing applied, theoretical, and methodological considerations led me to the following research questions:

1. To what extent can public perceptions of shale gas development via hydraulic fracturing be characterized as *social* representations?
2. What are the most frequently employed SR of shale gas development? To what extent, and how, does context affect commonality of SR?
3. Which social structural, cultural, historical, and physical landscape factors influence SR of shale gas development most heavily? To what extent, and why, do these factors differ across contexts?
4. What are the implications of SR of shale gas development for communication about this issue (e.g., from government, industry, and non-profit organizations)?

5. What are the implications of SR of shale gas development for policy development about this issue (e.g., on local, state, and national levels)?
6. How do SR of shale gas development relate to support for sustainable and resilient communities?

These guiding research questions can be summarized as follows: Do SR exist on this issue? What are they? How do they form? What does this mean for communication and policy? How can this knowledge help communities toward sustainable and resilient futures?

IV. Study Areas

I focused primarily on communities in the Marcellus Shale region of southern New York (NY) and northern Pennsylvania (PA). These sites were close enough to where I lived to allow for frequent trips to conduct interviews, attend meetings, and to seek out informal conversations in public places. I could also travel the landscape to observe directly the extent of development, the effects of development, and/or the physical context in which development would (potentially) occur. The comparison across NY and PA also allowed me to capture different levels of development and policy contexts.

The Marcellus Shale region stretches from central New York through Pennsylvania and into West Virginia and Ohio; it is the largest shale gas basin in the United States and potentially the second largest in the world. With an output of 12.5 billion cubic feet of natural gas per day, as of November 2013, the Marcellus Shale is the largest natural gas producing region in the US (the second most productive region is the Haynesville Shale, at 6.8 billion $ft.^3$/day) (US EIA 2013). Ninety-two percent of gas reserves in the basin are estimated to lie under Pennsylvania and New York, with the most productive areas in southern NY and northeast PA (US EIA 2012).

In addition to studying SR of shale gas development in the Marcellus Shale region, I included an international comparison in my research – communities in New Brunswick (NB), Canada. I chose NB for my international comparison due to shale gas attracting much public, media, and policy attention in the province in the years and months preceding my research.

Many meetings and protests had occurred, and many groups in favor of and opposition to shale gas development had formed. Additionally, the governmental differences in regulation of shale gas development between NY, PA, and NB presented an interesting opportunity for comparison. For example, the ownership of mineral rights by individual residents in the USA versus ownership of all mineral rights in Canada by the provinces is a major social structural difference that could only be accounted in an international comparison. The history and culture of the Atlantic province also differ notably from that of NY and PA.

Having narrowed my geographic focus, I proceeded to determine the number of study sites I would need. For social representations research, multiple comparisons are generally required to determine the extent to which, and why, SR vary across communities. An early challenge in my research was defining and operationalizing "community".

A. Defining a study "community"

Despite the difficulties inherent in generating a uniformly accepted definition of community (Bell and Newby 1971, Delanty 2003), Etzioni (1996) details a couple basic characteristics that convey a widely accepted understanding of what the academic and the layperson alike mean by "community". Etzioni suggests that communities are groups of individuals who interact through relationships with each other and who share a commitment to a basic set of values, norms, meanings, and identity. Etzioni's broad characterization of community is consistent with use of the construct of "community" in SR research. Two major approaches to conceptualizing "community" that fit Etzioni's description are communities of place and communities of interest (Delanty 2003).

A community of place is the type of community that most closely parallels the word "community" as used colloquially; it refers to the town, village, hamlet, etc. This construct represents community in its spatially-grounded form. While the spatial scale can vary, communities of place are, in essence, communities *with* propinquity. In this sense, a community

for my research could be the Village of Deposit, the Town of Sanford, the County of Broome, or the State of New York (each larger community contains the smaller communities within it).

Communities of interest, while still communities in Etzioni's sense of the term, are not necessarily spatially-grounded. The primary characteristic separating these communities from other types of communities is that their foundation lies in communication; they are in essence, as Habermas might contend, communication communities (Delanty 2003). Communities of interest are constructed fundamentally differently from communities of place. History of co-existence in a place creates norms and a shared culture that eventually produce shared values and, to some extent, a common identity. Communities of interest, on the other hand, attract individuals who, a priori, share certain norms, values, and, to some extent, a common identity. These could form within communities of place, but they need not, especially in an increasingly interconnected world. Another difference between these two types of communities is that the shared experiences that exist between members of a community of place are multifaceted, while members of a community of interest may limit their relations to only one realm (i.e., the interest[s] that bound them together initially). Selznick (1992) argues that communities of place, therefore, are stronger and provide a richer experience compared with communities that form around a particular interest or set of interests.

The importance, in social representations theory, of context for shaping SR led me to favor communities of place for my research. From a methodological point of view, many studies of SR have been effectively conducted in place-based communities (Deaux and Philogène 2001, Wagner and Hayes 2005). From an applied perspective, if I want my research to generate findings that are useful for planning, policy, communication, or governance, choosing municipal boundaries for a "community" also seems to be a wise decision.

Perhaps the most important influence on my decision to opt for communities of place is that studying SR in communities of interest could be tautological. Examples of communities of interest relevant to the issue of shale gas development could be landowner coalitions, environmental groups, explicitly anti- or pro-development grassroots organizations, government

agencies, etc. One way to characterize each of these groups would be an enumeration of their SR of shale gas development. Therefore, if the groups are defined by their SR of development, studying the extent to which they vary on SR of development would not be meaningful. My interest in SR of shale gas development was not in how different groups represent development, but rather in how members of the public represent development (with group membership being one potential contributing factor).

B. Selecting communities in NY, PA, and NB

Social representations theory asserts that representations form through social discourse. While some of that discourse may come via an individual's or group's engagement with mass media (e.g., newspapers, television, radio, Internet), additional discourse occurs via direct interpersonal conversation. Particularly for shale gas development, which often takes place in rural, somewhat isolated communities, one could predict that in-person conversation, and/or local media sources, would play a meaningful role in development of SR. The importance of local discourse in fostering SR broadly, and SR of shale gas development in particular, led me to use a relatively small geographic area to define each of my study communities.

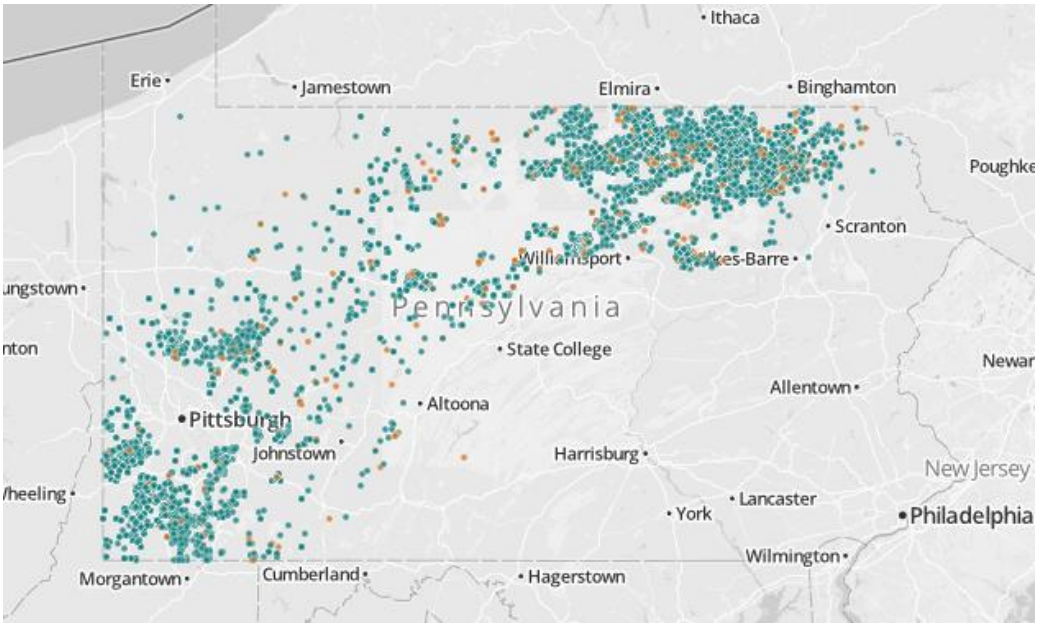
Based on the best methodological practices in SR research (see above), I selected newspaper content analysis, in-depth interviews, and a large sample-size survey as my primary methods. For each method, I needed to select slightly different communities. I chose each major research method to produce findings on SR in its own right, but also to inform the next data collection effort. I planned to conduct the content analysis first, then the in-depth interviews, then the survey. In an effort to overlap the communities for each method as much as possible, I choose the distribution areas for four major regional newspapers in the Marcellus Shale region as my communities for my content analysis, and then I chose several towns/townships in those same areas for my interviews. Finally, I distributed my survey to municipalities in that region.

1. Newspaper selection for content analysis

I selected regional newspapers located in four cities that are proximate to substantial natural gas development (see Figure 3.1) and are located in areas with geological potential for development (see Figure 3.2): Binghamton and Elmira in NY, Scranton and Williamsport in PA. The PA newspapers serve the region most affected by shale gas development in Pennsylvania. Variations in the degree of development locally do exist, however. Williamsport (PA) lies in Lycoming County, which had 706 active and permitted wells as of June 2012, compared to the one well in Lackawanna County, home to Scranton (PA) (http://stateimpact.npr.org/pennsylvania/drilling/counties/). Nevertheless, the county immediately to the north of Lackawanna, Susquehanna County, had 734 active and permitted wells, compared to the 792 wells in Tioga County, which lies north of Lycoming.

The NY newspapers are located in the area with greatest promise for shale gas development in New York. Binghamton and Elmira lie just across the NY/PA border. The de facto moratorium on shale gas development via hydraulic fracturing, in effect in NY from 2008 to present, has effectively prevented any drilling in NY. Nonetheless, both cities are close to high production areas in PA, with Binghamton less than ten miles from Susquehanna County, PA, and Elmira less than eight miles from Bradford County, PA (which had 1,142active or permitted wells as of June 2012).

Figure 3.1: Marcellus Shale active and permitted wells in PA, 1 January – 30 June 2012



Each dot represents an active natural gas well; green dots represent wells with no Pennsylvania DEP violations; orange dots represent wells with one or more violations. Obtained from NPR State Impact, http://stateimpact.npr.org/pennsylvania

Figure 3.2: Marcellus Shale "Play" and "Fairway"

The outer shaded area is the Marcellus "play" – the extent of the Marcellus Shale formation; the inner shaded area is the Marcellus "fairway" – the area where extraction is most economical. Obtained from Energy Tribune, www.energytribune.com/6933/marcellus-shale-facts

2. Study communities for interviews

My newspaper content analysis (i.e., reading and coding 1227 newspaper articles, and then interviewing the lead journalist who wrote on shale gas issues at each newspaper) provided substantial background on communities within my research area in which considerable discourse on shale gas development occurred. To narrow down the study sites for my interviews, I compared communities across several factors that potentially shape SR based on data from my content analysis and from secondary data collection (e.g., data from the Census and websites with shale gas-related data). The factors included: partisanship on the issue (i.e., is the community generally pro-development, anti-development, or mixed), presence of active shale gas-related groups, whether meetings or protests on shale gas occurred there, whether legislation on the topic had been passed in the community, political leaning of the community, population density, migration rate, percent unemployed, median household income, percent of families below the poverty line, average education level, percent of homeowners (versus renters), number of gas wells in the community and county (for areas where development was occurring), number of violations by the natural gas industry, money received from shale gas impact fees, and percent of the community leased to gas development (in areas not allowing drilling). I used these characteristics to select a range of communities across different values of each variable. I also used geologists' and engineers' predictions of where the most productive areas for shale gas development exist to select mostly communities in areas with high development potential, but also a few communities outside this region.

Through the aforementioned processes, and by conducting additional Internet searches and speaking on the phone with government officials who have worked on issues related to shale gas development, I identified an initial sample of ten communities each in NY and PA and five communities in NB suitable for my interviews. In NY and PA, I was able to drive to each potential study community. I ate breakfast in local diners while chatting with the proprietors and customers; I frequented local shops (again, striking up conversations); I drove the roads looking for evidence of development (and for actual signs in yards, advocating for or opposing

development); I purchased and read the local weekly newspapers. I stopped at town halls where I had conversations with municipal officials and read meeting minutes about shale gas development; in the evenings, I stopped at local watering holes to seek out additional conversation on representations of shale gas development from a different crowd.

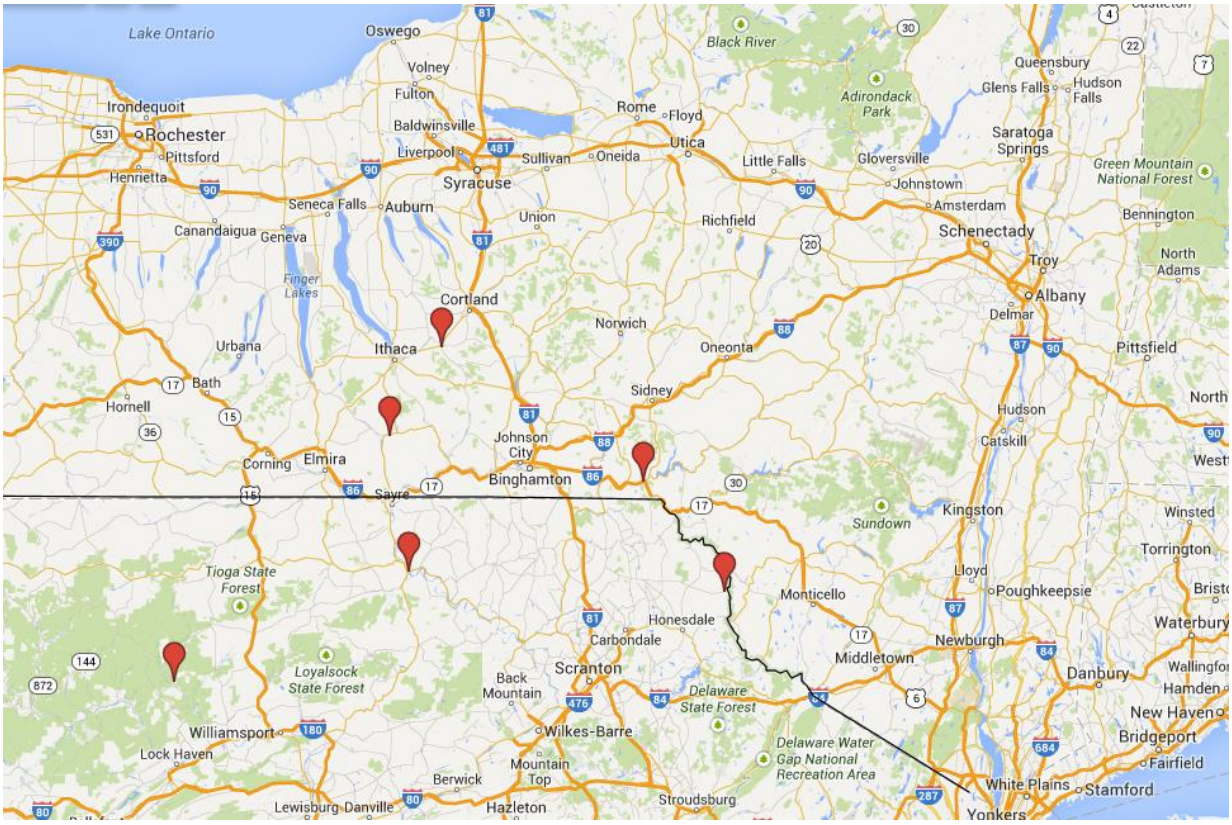
I used my initial field visits to supplement my findings from the content analysis and my secondary data collection. In NB, due to its distance from Cornell, I was unable to conduct initial reconnaissance in the same way. I read several government publications available online, spoke with government officials and non-profit organization leaders via telephone, and conferred with university academics in NB to supplement my initial data collection for the province. I did not conduct a systematic content analysis of newspaper coverage on shale gas development in NB, due to a small amount of coverage compared to coverage in the Marcellus Shale region newspapers. Nevertheless, I did read all the articles written on "fracking", hydraulic fracturing, and shale gas development in the major provincial newspapers.

I was able to capture a broad range of variability in factors potentially affecting SR by selecting three communities from NY, three from PA, and three from NB for my interviews.

a. USA communities

All my study communities in the USA lie in the northern portion of the Marcellus Shale region. My final study sites for my interviews in NY were the towns of Dryden, Sanford, and Spencer. In PA, I selected the townships of Cummings and Damascus, and the borough of Towanda. I locate each municipality in Figure 3.3 and highlight key characteristics of each municipality in Table 3.1.

Figure 3.3: Location of New York and Pennsylvania study communities



Note: The black line represents the border between NY and PA; the red pin points represent the study communities. The communities in NY, from west to east are Spencer, Dryden, and Sanford; the communities in PA from west to east are Cummings, Towanda, and Damascus.

Table 3.1: Characteristics of final USA study communities for interviews

Town / township / borough	Population density (persons / sq. mi.)[1]	Unemploy-ment rate (%)[1]	Median household income ($)[1]	Individuals below poverty level (%)[1]	Residents with at least a Bachelor's degree (%)[1]	% of county voted for Obama (2008)[2]	% of county voted for Obama (2012)[2]
Dryden	153	4.5	75,295	10.0	43.1	70.2	68.2
Sanford	28	10.5	41,563	13.1	16.9	53.2	50.9
Spencer	63	5.8	53,269	6.0	18.8	44.1	41.4
Cummings	4	8.9	40,125	2.8	15.8	37.3	32.7
Damascus	45	7.8	51,522	7.5	16.6	43.3	38.8
Towanda	2655	5.5	39,671	21.7	22.3	40.0	36.9

[1] 2008-2012 American Community Survey 5-year estimates, US Census Bureau
[2] The Washington Post (http://www.washingtonpost.com/wp-srv/special/politics/election-map-2012/president/)

Dryden, NY, lies outside the most productive area for shale gas development. It has seen intense discussion of this topic, including abundant public meetings. Local groups have formed in opposition to and support of development, although more opposition to development seems to exist, as evidenced by passage of ban on shale gas development via hydraulic fracturing in the Town. This ban received state and national attention when it was challenged legally by a gas company owning leases in Dryden. The courts consistently upheld the ban through multiple appeals; on 30 June 2014, the New York State Court of Appeals (the highest court in NY) ruled in favor of the Town. This has set a precedent for Towns in NY to regulate shale gas development via zoning laws. A large percentage of the Town was leased for gas development in March 2013 (when I finalized study community selection).

Sanford, NY, is at the epicenter of the most productive area for shale gas development. It also has experienced heated discussion of this topic with extensive public meetings. Local groups exist that oppose development, while other groups support development, including a large landowner coalition that signed a $110 million lease deal with XTO Energy in 2009. There seems to be more support for development as evidenced by passage of town legislation requesting that the state allow permitting for shale gas development. The Town has seen such ardent discussion of this topic that the town board banned conversation of this issue at meetings to allow for other work to take place. This ban received state and national attention when it was challenged due to limiting free speech. The town board eventually nullified the ban. The majority of the land in Sanford was leased for gas development in March 2013.

Spencer, NY, is on the fringe of the most productive area for shale gas development. Again, public meetings on this issue have been numerous. Local groups both support and oppose development. As in Sanford, town legislation has passed that requests that the state allow permitting for shale gas development – indicating that support may outweigh opposition in this community. The majority of the town was leased for gas development in March 2013.

Cummings, PA, has the largest number of shale gas wells of any municipality in PA. While development has been intense, organized public discussion of shale gas development has

been limited due to the township's low population density. As of 30 June 2012, there were 224 natural gas wells permitted in the township. Between 1 January 2009 and 30 June 2012, 135 violations were recorded at these wells (by the Pennsylvania Department of Environmental Protection). In 2012, the township received $500,000 from the Commonwealth as part of legislation mandating that municipalities experiencing development receive part of an impact fee assessed on natural gas companies.

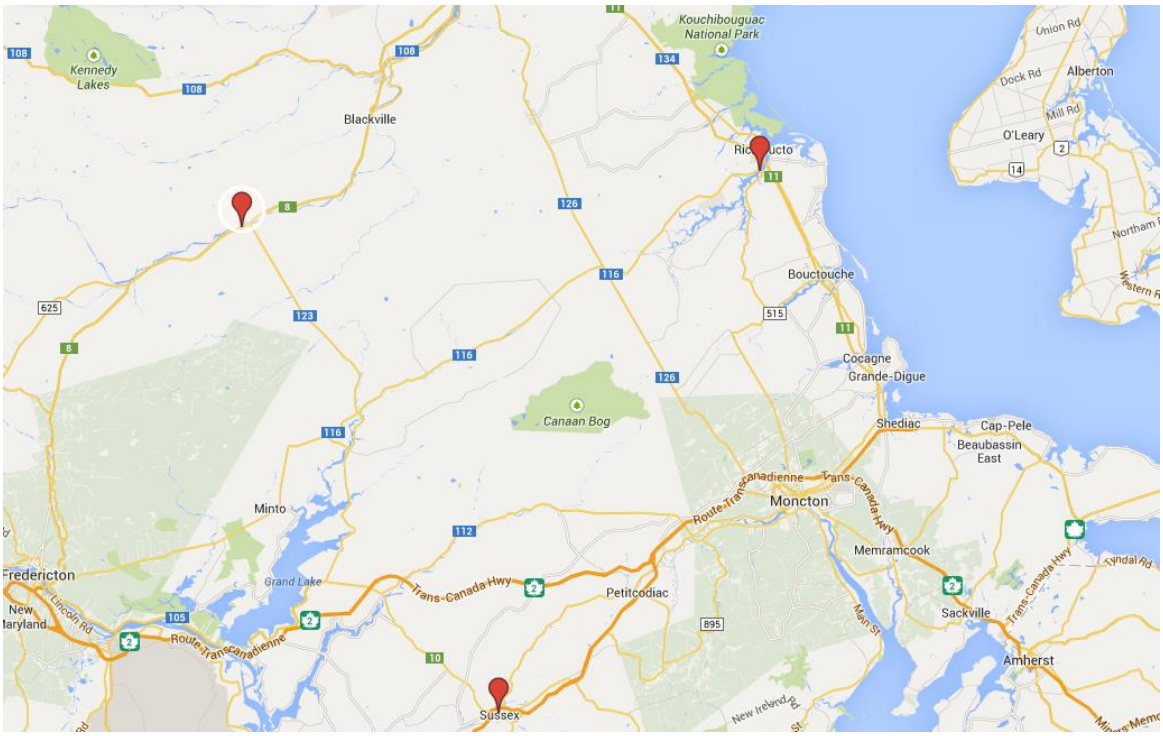
Damascus, PA, is outside the most productive area for shale gas development. This township is on the border with NY and grassroots groups active in NY on this issue also operate in Damascus. Additionally, a landowner coalition, comprised of individuals who would like to lease their property for shale gas development, is active in this town. The town hall meetings have attracted substantial crowds. The township experienced a lengthy discussion of whether it could use zoning to limit the extent of development. The town board ultimately decided that it could not use zoning in this fashion based on Commonwealth law (the courts later ruled that municipalities *could* use zoning in this fashion). As of 30 June 2012, there were zero natural gas wells permitted in the township. In 2012, the township received $0 from the Commonwealth as part of the impact fee legislation.

Towanda, PA, is the county seat of the county with the largest number of shale gas wells in PA. Traffic in the borough has increased dramatically over the last half decade. Because Towanda is a relatively densely populated area, it has a number of retail businesses that have potentially been affected by the increased development locally. As of 30 June 2012, there were zero natural gas wells permitted in the borough proper and fourteen active wells in the surrounding Towanda Township, with seven violations at those wells from 2009-2012. In 2012, the borough received $173,551 from the Commonwealth as part of the impact fee legislation; the township received $205,928.

b. Canadian communities

My study sites for interviews in NB were the towns of Richibucto and Sussex, and the village of Doaktown. I locate each municipality in Figure 3.4 and highlight key characteristics of each town/village in Table 3.2. Figure 3.5 shows all of the New Brunswick study communities for my interviews in relation to the Marcellus Shale region study communities.

Figure 3.4: Location of New Brunswick study communities



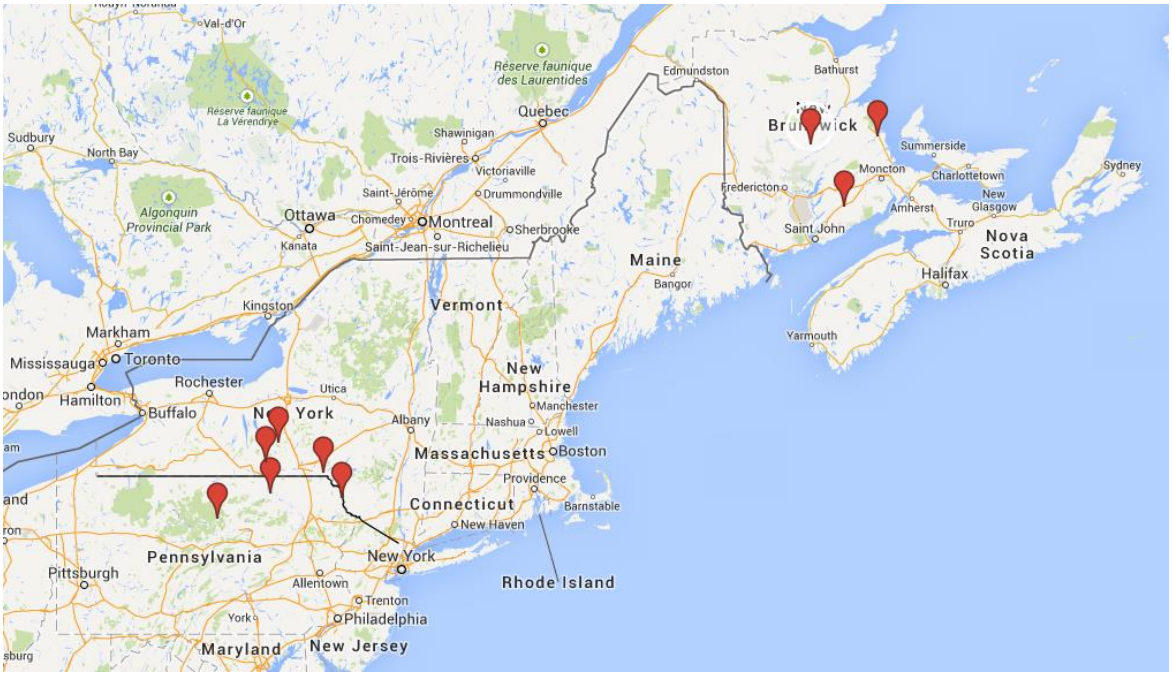
The communities (red pin points) from west to east are: Doaktown, Sussex, and Richibucto.

Table 3.2: Characteristics of final Canadian study communities for interviews

Town / village	Population density (persons / sq. mi.)[1]	Unemploy-ment rate (%)[2]	Residents with at least a Bachelor's degree (%)[2]	Native English speaker (%)[1]	Native French speaker (%)[1]	Population change (2006-2011) (%)[1]
Doaktown	71	35.0	6.3	97	3	-10.7
Richibucto	280	20.5	4.7	28	71	-0.3
Sussex	1232	7.4	12.6	97	2	+1.7

[1] 2011 Census, Statistics Canada, [2] 2011 National Household Survey, Statistics Canada

Figure 3.5: Location of NY, PA, and NB study communities



All mineral rights in Canada are "vested to the Crown", which functionally means that they are the common property of the citizens of each respective province and are controlled by the provincial governments, acting in the interests of their citizens. In 2010, the NB provincial government leased 2,518,519 acres of mineral rights to SWN Resources Canada, a wholly-owned subsidiary of Houston-based Southwestern Energy Company. This lease extends from southwest NB, almost at the Maine (USA) border, across the province in a band northeast until it reaches the Atlantic Ocean. Doaktown is squarely in the center of this band. Richibucto lies on the coast at the far eastern end of the band. Sussex does not lie on top of leased mineral rights but is very close to 243,601 acres of mineral rights leased to Corridor Resources Incorporated.

Unconventional gas development began in the early 2000s in the Sussex area; by 2008, Corridor Resources had drilled and hydraulically fractured 35 wells. These wells were drilled in the Maritimes Basin, a collection of sedimentary layers formed during the Devonian period that underlie parts of New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland (New

Brunswick Energy and Mines 2010). There is natural gas in both shale and sandstone near Sussex; both have seen exploration (Corridor Resources 2008).

The Frederick Brook Shale (part of the Maritimes Basin) that underlies Sussex is the same shale that forms SWN Resources' holdings spanning central NB. As of early 2014, SWN Resources had not drilled any wells, but it had conducted seismic testing to determine potential for shale gas development. This seismic testing drew numerous protests, particularly in the summer and autumn of 2013. Protests were especially prominent in the area near Richibucto, leading to weeks of standoff between industry, protesters, and police. Eventually, dozens of arrests occurred. Protests and meetings on shale gas development have taken place throughout the province, but public opposition has been strongest in the Acadian region, close to the Atlantic coast, and in the provincial capital city of Fredericton. The Acadian region contains a higher percentage of French-speaking residents than most other regions in the province. Indigenous peoples in this area have also been involved in the opposition movement.

During the summer of 2012, the New Brunswick Ministry of Energy and Mines conducted a series of nine public meetings across the province to answer questions and hear public perspectives on shale gas development (LaPierre 2012). While opposition to development was high in most meetings, publicly-stated support for development was most noticeable at the meeting in Blackville (near Doaktown). Support and opposition were evident at the meeting in Norton (near Sussex), while the vast majority of comments at the Bouctouche meeting (near Richibucto) were in opposition to development.

3. Study communities for the survey

After conducting my interviews, I analyzed the conversations for social representations of shale gas development. I examined what the primary representations were and how they varied across study communities; I then designed a survey to test for the generalizability/transferability of these findings to the general population in local communities. The survey only focused on NY and PA, because colleagues of mine were planning a separate survey of NB residents that

would include several of the same questions from my survey (that instrument is still in development as of this writing).

I selected study communities for my survey by expanding the regions surrounding the six communities used for my interviews. A range of urban and rural areas existed *within* each of the six regions and *across* regions. I used the same characteristics as I used for selecting the interview communities (e.g., passage of legislation on shale gas development, number of wells drilled, amount of land leased, demographic statistics, political leaning, etc.), but I was able to incorporate greater variability across these metrics due to having a larger sample size of communities in the survey, compared to for the interviews.

Ultimately, I selected 17 municipalities in NY and 17 in PA for inclusion in the survey. I mailed surveys in a four-wave mailing (i.e., survey, reminder, second survey, second reminder) to 147 randomly-selected households in each municipality. My primary rationale for selecting 34 municipalities was that it would provide a large enough sample size at the group level to compare representations *within* and *across* communities. Accounting for the hierarchical structure of data collected across communities allow the researcher to model individual and societal level effects on SR at the same time, while not aggregating or disaggregating data across levels (which can lead to inappropriate statistical error estimates).

V. Methods

The reader now knows *what* I sought to study, *why* I studied it as I did, and *where* I studied it. In this section, I enumerate the means by which I collected and analyzed my data.[4]

A. Newspaper content analysis

For my initial examination of the content, valence, and variation across contexts of social representations of shale gas development, I performed a content analysis of articles mentioning

[4] Note: Cornell University Institutional Review Board (IRB) approvals for Human Subjects research for each of the components of this research are presented in Appendix A.

the words "Marcellus Shale" in four regional newspapers; two in southern NY and two in northern PA (see Table 3.3).[5] I followed up on the patterns that emerged in this content analysis by conducting interviews with the journalist who wrote the largest percentage of articles mentioning "Marcellus Shale" at each of the four newspapers.

Table 3.3: NY/PA regional newspaper articles mentioning "Marcellus Shale", 2007-2012*

	Binghamton Press and Sun Bulletin (NY)	**Elmira** Star-Gazette (NY)	**Scranton** Times-Tribune (PA)	**Williamsport** Sun-Gazette (PA)	**TOTAL**
2008	33	15	19	20	**87**
2009	60	66	33	46	**205**
2010	91	87	112	112	**402**
2011	62	65	102	114	**343**
2012	44	17	57	72	**190**
TOTAL	**290**	**250**	**323**	**364**	**1227**

* The number of articles listed here is the number I coded for the content analysis. The total number of articles from each year and for each newspaper is three times the amount listed here.

I selected newspapers as the medium for my content analysis because a random sample study of 6,000 residents in the Marcellus Shale region in NY and PA revealed that mass media (i.e., newspaper, television, and/or radio, but excluding Internet) is the most frequently used source for information on shale gas development (Stedman *et al.* 2012). Twice as many respondents indicated that mass media provided "a great deal of knowledge" on shale gas development, compared to every other information source, save "neighbors, friends, and relatives".

I constructed the sample by searching for newspaper articles mentioning "Marcellus Shale" in each newspaper. Searching for articles with the words "Marcellus Shale" allowed me to capture most articles focused on shale gas development while excluding additional articles on

[5] Total daily circulation (Monday-Friday) for the newspapers: Binghamton Press and Sun Bulletin – 34,111; Elmira Star-Gazette – 15,181; Scranton Times-Tribune – 47,663; Williamsport Sun-Gazette – 22,795 (Audit Bureau of Circulations, June 2012)

natural gas, but extraneous to shale gas drilling and extraction. I obtained the Binghamton (NY) articles through ProQuest, the Scranton (PA) articles through Access World News, the Williamsport (PA) articles from the free online archives of that newspaper, and the Elmira (NY) articles through the Binghamton University library, which subscribes to that newspaper.

The content analysis sample included every third article from each newspaper in a chronologically ordered list of the coverage from 1 January 2007 – 31 December 2012. I selected this time frame because 2007 was the first year during which the words "Marcellus Shale" appeared in any of the four newspapers. The selection criteria generated a final sample of 290 articles from Binghamton (NY), 250 from Elmira (NY), 323 from Scranton (PA), and 364 from Williamsport (PA) (for a total sample of 1,227 articles).

I designed a coding scheme, in advance of any coding, that allowed me to systematically record presence or absence of multiple references related to content on shale gas development. The primary items for which I coded were: (1) presence/absence of references to specific impacts associated with development and (2) valence of those impacts. I coded each article for impacts of shale gas development by recording presence/absence of a host of environmental, economic, or social effects of development in each article (Table 3.4). During coding, I allowed additional impacts to emerge; if the coding scheme did not include a specific type of impact, I created a new code (see Appendix B for the final coding scheme).

Table 3.4: General and specific impact category descriptions (impacts of shale gas development)

Environmental effects	**Economic effects**	**Social effects**
Effects on **drinking water**	Effects on **tax revenue**	Effects on **traffic**
Effects on **lakes**	Effects on **taxpayer costs**	Condition of **roads**/ bridges
Effects on **streams/rivers**	Effects on **local business**	Effects on **crime** rate
Other references to **water quality** that are too vague to fit the categories above	Financial aspects of **royalties**	Effects on **community character** or rural way of life
Impacts due to **wastewater**	Financial aspects of **leases**	Effects on amount of **noise**
Effects on **water supply** (e.g., volume of water used)	Financial aspects of **mineral rights**	Effects on municipal and/or emergency **services**

Problems related to **methane migration**	Effects on price of **rental** property	Effects on **housing** availability
Concerns about **naturally occurring radioactive materials**	Effects on **jobs** (incl. availability, wages paid, job training, etc.)	Effects on community **infrastructure** beyond roads and bridges
Effects on **soil quality**	Effects on **property values**	Issues related to **dust**
Effects on **wildlife**	Effects on **tourism**	Effects on local **aesthetics**
Effects on **fish** and other aquatic animals	Costs related to **water treatment**	Effects related to **light pollution**
Effects on wildlife **habitat**	Production of **cheap energy**	Effects on **parking** (availability, need for, etc.)
Effects on **greenhouse gas emissions**	**Broad** economic effects (i.e., gas development affects the economy, but no specific effect is stated)	Issues related to the **distribution of gains** earned
Production of **solid waste** (e.g., rock cuttings, sludge)		Effects on US **energy independence**
Effects on **air quality**		Effects on driving and pedestrian **safety**
Production of **clean energy** by increasing gas available		**Broad** social effects (i.e., gas development affects local communities, but no specific effect is stated)
Effects on **forests**		
Broad environmental effects (i.e., gas development affects the environment, but no specific effect is stated)		

After recording impacts, I coded for the valence (positive, negative, neutral, or mixed [positive and negative]) of each impact. I labeled an impact positive if the journalist or a person/organization cited in the article specifically identified the impact as good (e.g., through words such as: beneficial, increased opportunity, promising, boon, etc.). I labeled negative impacts identified as bad, (e.g., words such as: risk, harmful, disaster, concern, destroy, etc.). Neutral impacts made no mention of a good or bad outcome; the impact was merely mentioned (e.g., "wastewater is created when wells are hydraulically fractured"). (However, a positive impact could be that wastewater can generate revenue by being treated at a municipal plant, benefiting residents by lowering taxes. A negative impact could be that wastewater could contaminate a river, killing fish.) Individual impacts were labeled as having mixed valence if the

same impact was listed as positive and negative in the same article (e.g., one scientist asserts that shale gas extraction benefits global climate change by reducing emissions while another scientist claims that it increases emissions, exacerbating climate change).

Following my coding of each article for impacts and valence, I trained two independent coders to conduct a reliability analysis by coding approximately 9% of the total sample (108 articles; at least 25 from each newspaper). For impacts and valence, I compared all codes to determine level of agreement between the lead coder and the reliability coder. For all 18 environmental impacts, 13 economic impacts, 16 social impacts, and 4 valences for which we coded, each code exhibited at least 90% agreement and had a Krippendorf's alpha of 0.9 or above. The coders and I reviewed all cases of disagreement to determine the appropriate code.

1. Data analysis

I calculated the percentage of articles from each newspaper that mentioned each impact. My list from the original coding scheme along with emergent codes produced eighteen environmental impacts, thirteen economic impacts, and sixteen social impacts (Table 3.4). I relied on frequency statistics and z-tests for differences in proportions to highlight the most common representations and differences in representations across newspapers.

Next, for each article, I aggregated the valence of impacts across all environmental impacts mentioned. If all impacts mentioned were positive, negative, or neutral, then I labeled that article's valence for environmental impacts as positive, negative, or neutral. If the article included positively *and* negatively valenced impacts, I coded the article as having mixed environmental valence (but if an article had positive and neutral or negative and neutral valences, I coded those articles as positively and negatively valenced, respectively). I performed this same analysis for valence related to economic and social impacts. Once again, I used frequencies and z-tests to characterize SR and differences in SR across newspapers.

After examining SR across newspapers, I compared SR longitudinally across years in which coverage occurred. I aggregated all environmental impacts into two variables: one that

measured whether or not at least one of the eighteen environmental impacts for which I coded was mentioned in the article (which I coded as 0 or 1), and a variable that indicated the total number of unique environmental impacts mentioned in the article (coded as an integer, 0-18). For example, if an article mentioned impacts on drinking water three times, but no other impacts, the value for this second variable would be 1; if the article mentioned effects on drinking water, earthquakes, and wildlife health, the value for this variable would be 3. I conducted the same aggregation process to create two variables for economic impacts and social impacts. I also used this procedure to create two variables for total impacts, combining codes for all 47 impacts.

For the longitudinal analysis, I used a generalized linear model with logit link function and binomial distribution for four models with presence/absence of reference to at least one impact as their dependent variables (i.e., all impacts, environmental impacts, economic impacts, and social impacts). For the longitudinal analysis using number of impacts as the dependent variable, I used a generalized linear model with log link function and Poisson distribution. In all eight models (four for presence/absence, four for number of impacts), I entered year as a categorical independent variable and controlled for the newspaper in which the article appeared as an additional multiple nominal predictor variable. When testing for significant differences across years, I used Bonferroni corrections to account for multiple comparisons in all models.

2. Interviews with journalists

After coding the articles and analyzing the data, I interviewed the journalist from each newspaper who wrote the most news articles about natural gas development in the Marcellus Shale from 2007 through the end of 2012. I interviewed the top two journalists from the Binghamton (NY) and Elmira (NY) papers because the same two people were the most prolific authors at each paper (due to Gannett owning both newspapers). The two newspapers printed several of the same articles.

The four journalists I interviewed wrote substantial percentages of the coverage at each newspaper (Table 3.5); three of them wrote over 200 newspaper articles on shale gas issues. I

interviewed the journalists after observing the newspapers' primary SR of impacts of shale gas development to follow up on specific patterns that emerged in each paper, and to seek potential explanations. Because the newspapers differed somewhat in the impacts they focused on most heavily, I sought to discover aspects of local context and/or contrasting journalistic norms that contributed to this variation in representations (see Appendix C for a full list of the questions I asked in these interviews).

Table 3.5: Authorship of newspaper articles mentioning "Marcellus Shale", 2007-2012*

	Binghamton Press and Sun Bulletin (NY)	Elmira Star-Gazette (NY)	Scranton Times-Tribune (PA)	Williamsport Sun Gazette (PA)
% of articles written by lead journalist (07-12)	44%	25%	24%	18%

* For the Binghamton and Elmira newspapers, I report the percentage written by the top two journalists, who both wrote for both papers.

B. Interviews and visits to study communities

The content analysis, my review of materials available online (e.g., other mass media coverage, anti/pro-fracking group websites, municipal government webpages, blogs, etc.), my initial reconnaissance visits to my study communities, and my attendance at several public meetings on shale gas development prepared me to interview key individuals involved in shaping or facilitating discourse on this topic. This background equipped me with a basic understanding of the SR of shale gas development in my study communities, which allowed me to ask informed follow-up probes during the interviews.

The background also helped me develop a list of potential interviewees. I sought to meet with people who had been outspoken on this topic and who had been trying to direct the discourse in one way or another; these were typically ardent proponents or opponents of shale gas development. I also identified people who worked diligently behind the scenes to ensure their views were heard on this issue. To capture the full spectrum of SR, including nuanced

representations that may not be evident at the poles on this issue, I also selected potential interviewees (often government officials) who did not have strong personal beliefs about shale gas development, but who were responsible for facilitating public discourse on this issue (e.g., at town hall meetings).

In March and April, 2013, I contacted potential interviewees via telephone and e-mail. A few individuals did not respond to my messages, but the large majority agreed to an interview; no one explicitly declined an interview. During April and May, 2013, I conducted interviews with eleven people heavily involved in the discourse on shale gas development in NY (three in Dryden, four in Sanford, three in Spencer) and with ten people in PA (three in Cummings, five in Damascus, two in Towanda). I conducted one to four interviews per day and made day trips to the study communities from my home in Ithaca, NY. In PA, three of my interviews were with government officials, three were with activists on the issue (two opposed to development, one in favor), three were with other residents (involved in the discourse, but not blatantly advocating for or against shale gas), and one was with a leader of a landowner coalition. In NY, three of my interviews were with government officials, five were with activists on the issue (four opposed to development, one in favor), and three were with other residents.

For two weeks in May 2013, I journeyed to New Brunswick, Canada, where I spent about four consecutive days in each of my three study communities. In and around Doaktown I interviewed three government officials, one activist (opposed to development), and two other residents. In and around Richibucto I interviewed one government official and four activists (all opposed to development). In and around Sussex I interviewed the president of the local chamber of commerce, four activists (three opposed to development, one in favor), and five other residents. Additionally, in Sussex I conducted a focus group interview with eight residents opposed to shale gas development. (I tried, with the help of a local resident, to schedule a focus group interview with a group of proponents of development. Ultimately, it did not work out because too many of the potential participants were concerned that I was from Cornell University, which is home to some professors who are outspoken opponents of shale gas

development.) Finally, while in Sussex, I traveled with some local residents to an anti-shale gas concert/rally in nearby Albert County. I spoke briefly with several concert organizers and attendees.

While in NB, I interviewed five additional individuals who were not directly associated with my study communities, but who were well versed in the discourse on shale gas development across the whole province. This group included: (1) the lead person focusing on shale gas at the Conservation Council of New Brunswick (the main non-profit organization in the province working on shale gas issues), (2) a staff member from the provincial government's Ministry of Energy and Mines, (3) the Minister of Energy and Mines, (4) a professor at the University of New Brunswick working in this area, and (5) a graduate student who had completed his MS thesis on public perceptions of and reactions to shale gas development in NB.

In individuals' homes, places of work, and in local restaurants I interviewed the 47 key informants from NY, PA, and NB. I digitally recorded each interview and took notes during each interview (unless an interviewee requested not to be recorded, in which case I took even more detailed notes). Consistent with the aforementioned best practices in SR research, I began each interview with a word association component. After introductions and pleasantries, I handed the interviewee a blank sheet of paper with two lines, bisecting the sheet vertically and horizontally. This created four boxes. I requested of my interviewees, "in the four boxes, please write or draw the first four things that come to mind when I say 'shale gas development via hydraulic fracturing'". I told interviewees they could write a single word, a phrase, an entire sentence, or draw a picture. I explained that I would use this sheet as a point of departure for our conversation, allowing their perspectives, not my perceptions of what is relevant, to guide the discussion.

The reminder of each interview proceeded primarily as a natural conversation flowing from the interviewee's responses to the word association task. See Appendix D for my interview guide. While I gathered the information elicited in the questions in the appendix from each interview, I rarely asked those exact questions and I never asked them in the precise order listed.

I followed up on the topics the interviewees selected in their word associations, making connections to the interview guide when appropriate. Interviews lasted between 30-100 minutes, with the average length around 50 minutes.

I did not fully transcribe the interviews; I listened to the audio recordings and reviewed my hand-written notes from each interview. During this process, I pursued answers to the six research questions: (1) I identified key social representations that were emerging from the interviews, (2) I examined variation in SR across study communities, (3) I classified factors contributing to emergence of SR, (4) I began to consider implications of the emergent SR for communication and policy, (5) I established connections between SR of shale gas development and support for community resilience/sustainability, and (6) I analyzed comments about how perceptions of shale gas issues surfaced to determine the extent to which representations were *social* representations. As I recorded patterns and themes relating to the research questions, key quotes emerged from my interviewees that exemplified these findings. I present these themes, patterns, and quotes in Chapter Five.

In an effort to better "triangulate" my findings, I collected data on SR of shale gas development through as many means as possible. I gathered additional data when I visited each study community for interviewing. Before my interviews, between interviews, and following my interviews I consistently read local newspapers, frequented local shops, chatted with servers and cliental at local restaurants, visited bars/pubs to speak with bartenders and guests, and drove roads in the community to view the landscape, evidence of shale gas development, and signs protesting against/advocating for shale gas. The casual conversations helped me immeasurably by providing topics for follow up questions during the interviews and by offering hints for how to connect patterns and themes that emerged during the interviews.

C. Survey of NY and PA residents

My interviews supplied "reactive" individual-level data that I was able to interpret alongside the "non-reactive" societal-level data from the content analysis. Of course, the content

analysis also provided individual level data from the letters to the editor I coded, and from quotes of local residents in news articles. Similarly, the interviews provided some societal-level data when interviewees described the perspectives of groups they belonged to, and when they recounted public events in which they had participated.

I used the foregoing data collection and analysis to design questions for a survey, which I mailed to a random sample of 147 households in each of 17 municipalities in southern NY and 17 municipalities in northern PA. I describe the selection criteria for these municipalities in the "Study Areas" section above. Table 3.6 lists all the study communities with a few descriptive characteristics. Notice that some municipalities are actually a combination of two municipalities. Because I mailed surveys to 147 households in each municipality, I combined municipalities with very low populations to not oversaturate any area with surveys. Figure 3.6 places the survey distribution area in the geographical context of New York and Pennsylvania.

Table 3.6: Municipalities receiving surveys in New York and Pennsylvania

Community name	Type of municipality	County	State	Total population	Population density (/ sq. mi.)	Unemploy -ment rate (%)	% with Bachelor's degree
Binghamton	City	Broome	NY	47,107	4,244	10.7	23.5
Fenton	Town	Broome	NY	6,649	199	7.6	23.7
Sanford	Town	Broome	NY	2,564	28	10.5	16.9
Windsor	Town	Broome	NY	6,260	67	6.0	13.3
Elmira	City	Chemung	NY	29,173	3,839	11.2	13.2
Van Etten	Town	Chemung	NY	1,528	37	13.1	13.4
Cortland	City	Cortland	NY	19,271	4,941	7.9	25.8
Harford & Virgil	Towns	Cortland	NY	3,231	45	4.0	22.2
Deposit	Village	Delaware	NY	1,787	1,375	7.1	14.3
Tompkins & Masonville	Towns	Delaware	NY	2,701	17	10.2	14.0
Candor	Town	Tioga	NY	5,296	56	6.0	14.6
Owego	Village	Tioga	NY	3,891	1,441	8.4	29.1
Spencer	Town	Tioga	NY	3,135	63	5.8	18.8
Caroline	Town	Tompkins	NY	3,260	59	9.0	41.3
Dryden	Town	Tompkins	NY	14,455	153	4.5	43.1
Groton	Town	Tompkins	NY	5,945	120	6.9	16.1
Newfield	Town	Tompkins	NY	5,192	88	12.6	23.9

Athens	Borough	Bradford	PA	3,369	1,872	4.2	20.0
Athens	Township	Bradford	PA	5,234	116	5.3	22.0
Towanda	Borough	Bradford	PA	2,921	2,655	5.5	22.3
Troy	Township	Bradford	PA	1,548	42	4.7	20.8
Wysox	Township	Bradford	PA	1,570	68	6.8	18.3
Cogan House	Township	Lycoming	PA	853	12	6.6	13.2
Cummings & McHenry	Townships	Lycoming	PA	443	3	10.0	12.1
Jersey Shore	Village	Lycoming	PA	4,355	3,629	8.6	12.6
Mifflin	Township	Lycoming	PA	1,093	39	6.4	11.2
Porter & Watson	Townships	Lycoming	PA	2,432	77	9.2	16.2
Williamsport	City	Lycoming	PA	29,441	3,099	12.6	18.0
Bridgewater & Brooklyn	Townships	Susquehanna	PA	3,615	55	4.4	17.4
Dimock & Springville	Townships	Susquehanna	PA	3,272	54	4.2	18.9
Montrose	Borough	Susquehanna	PA	1,794	1,380	11.8	19.4
Damascus	Township	Wayne	PA	3,648	45	7.8	16.6
Honesdale	Borough	Wayne	PA	4,458	1,115	7.8	18.7
Manchester & Lebanon	Townships	Wayne	PA	1,372	25	7.7	14.2

Figure 3.6: Extent of survey coverage in New York and Pennsylvania

Note: The highlighted areas on the map represent the counties to which I mailed surveys. Only select municipalities in each county received surveys (see Table 3.6).

1. Survey design

a. Question content

I designed my survey questions to collect data on: (1) the extent to which individuals held certain social representations of shale gas development, (2) to identify the degree to which a range of factors contributed to development of SR, (3) to diagnose the most important fora for emergence of SR, and (4) to analyze the connection between SR of shale gas development and support for community sustainability/resilience. I provide the full survey in Appendix E. The primary SR about which I asked close-ended questions were: (1) likelihood of various impacts occurring due to shale gas development, (2) magnitude of effect on one's quality of life if those impacts were to occur, (3) support for/opposition to shale gas development, and (4) importance of various ethical values for decision making on shale gas development. I also included a word association task to characterize SR via the open-ended question, "Please write, as quickly as you can, any words or phrases that come to mind when you think of 'shale gas development via hydraulic fracturing'."

In terms of factors affecting development of SR, I included questions about aspects of local history, cultural background, social structure, and individual attributes that emerged from the content analysis, interviews, and field visits as important influences on SR. My questions about fora for evolution of SR asked about: (1) commonly used sources for information on shale gas development, (2) engagement in activities related to expressing an opinion about development, and (3) extent of conversation with other community members about development. I finished the survey with a number of demographic questions and questions about the individual's home environment (e.g., do you have a gas lease? From where does your water come? How much land do you own?)

Other than basic demographic questions, I derived the vast majority of the questions included in the survey from my newspaper content analysis and interviews. Nevertheless, I did incorporate the three questions from a survey on "Resource Management Policy and Climate Change", disseminated to Canadian decision-makers that was designed to understand factors

affecting climate change policies (Wellstead *et al.* 2002) (see Question 18, Appendix E). The three questions fit under the heading of "general policy attitudes" in that survey. Of the twelve "general policy attitude" questions that Wellstead and colleagues included in their survey, I selected the three that most closely paralleled factors affecting views on shale gas development as discussed in the content analysis and the interviews. The second sub-question in Question 18 (Appendix E) comes from the New Environmental Paradigm survey and the third sub-question has been used in several other surveys on views about natural resource management. These questions have been shown to be reliable and valid and potentially to predict beliefs about management of natural resources.

To investigate the connection between SR of shale gas development and support for community sustainability/resilience, I included multiple variables that measured support for / opposition to sustainability and multiple variables that measured support for / opposition to resilience in one's community. I selected the wording for these variables based on a reading of academic literature on sustainability and resilience. I sought to include three statements that captured the essence of sustainability and three statements that accurately characterized resilience. Sustainability is notorious as an extremely poorly defined and operationalized concept (Böhringer and Jochem 2007, Mori and Christodoulou 2012, Wilson *et al.* 2007). For example, differing measures of national sustainability have placed the same nation in the top five in the world on one metric while in the bottom five in the world on a different metric (Wilson *et al.* 2007). Yet, the wealth of academic attention to sustainability also confirms the generally agreed upon importance of measuring and understanding sustainability for policy making and public communication (Singh *et al.* 2009).

Even as a standard definition remains elusive, some generally agreed upon characteristics can be gleaned from previous work. From even before the seminal 1987 Brundtland Report, the needs of future generations were considered in definitions of sustainability (Allen 1980). Virtually all work on sustainability additionally acknowledges the necessity of accounting for environmental, economic, and social indicators of well-being (Mori and Christodoulou 2012).

Mori and Christodoulou (2012) provide additionally basic attributes of sustainability that such indicators could be checked against: (1) consideration of present and future consequences, (2) acknowledgment of uncertainties, (3) engagement of the public, and (4) consideration of equity. Moldan and colleagues (2012) add to this list: (5) understanding of non-linear evolution (e.g., thresholds, tipping points), (6) taking feedbacks (positive and negative) into account, (7) regard for different time scales, (8) flexibility (to react to changing situations), and (9) respect for living nature. From these characterizations of sustainability, I ultimately selected the second, fourth, and sixth statements in Question 17, Appendix E, to operationalize sustainability in my survey.

The concept of resilience has also been muddled by many definitions, but perhaps not to the extent that sustainability has. Resilience has been studied and promoted for over four decades (Holling 1973); in the 1960s and 1970s it emerged in relation to ecological processes. Starting in the 1990s, resilience was applied more holistically to social-ecological systems (Berkes *et al.* 2003, Berkes and Folke 1998, Costanza *et al.* 1993, Davidson-Hunt and Berkes 2003). In a review of literature on resilience as a tool for analyzing social-ecological systems, Carl Folke (2006, 253 and 257) highlights major ways in which resilience has been defined and operationalized: (1) "the capacity to absorb shocks and still maintain function", (2) "the capacity for renewal, re-organization and development", (3) "sustained diversity and individuality of components", and (4) "localized interactions among those components".

Folke (2006) explicitly defines resilience as "the capacity of a system to absorb disturbance and re-organize while undergoing change so as to still retain essentially the same function, structure, identity and feedbacks" (259). Similarly, Folke and colleagues (2002, 437) offer the following definition, "the capacity to buffer change, learn and develop". Folke also links resilience to "adaptive capacity" and offers that "it is also about the opportunities that disturbance opens up in terms of recombination of evolved structures and processes" (2006, 259).

The foregoing definitions and explanations of resilience led me to select the first, third, and fifth statements in Question 17, Appendix E, to operationalize sustainability in my survey.

Additionally, the second statement, which I primarily selected to characterize sustainability also speaks clearly to the concept of social-ecological resilience.

b. Question format

In addition to considering content of the survey questions; I gave detailed attention to the format in which I asked the questions. Several questions asked about the extent to which a respondent agreed/disagreed or supported/opposed a series of statements. I elected to use a six-point Likert scale in each of these instances. The number of response options in a rating scale raises two key considerations: (1) how large should the number of response options be and (2) should there be a mid-point in the scale.

Numerous studies of questionnaire scales with different numbers of points have established that 5-7 point scales have the highest reliability and validity (see Krosnick and Fabrigar [1997] for a review of this research). While not unequivocal, the research generally indicates that up through seven response options, additional response options increase reliability and validity, although they do, at the same time, increase cognitive effort required from respondents. Beyond seven response options, differentiation between the meanings of options becomes ambiguous (Alwin and Krosnick 1991).

Some equivocation on the performance of scales of different lengths comes from studies such as Chang's (1994), which demonstrated that under distinct conditions, both shorter and longer scales can have higher reliability. Chang, in a comparison of 4-point and 6-point scales, revealed that when respondents are relatively familiar with the content asked about in a survey, the six-point scale increases reliability and validity over the four-point scale because the statistical gain in Pearson correlations outweighs the increase in systematic method variance. In cases where the survey audience is unfamiliar with the subject of the survey, the opposite effect occurs.

In a comprehensive review of several decades of methodological research on survey scales, Krosnick and Presser (2010, 269) advocate for the seven-point scale. They assert,

> The value of adding even more points to a rating scale may depend upon how refined people's mental representations of the construct are. Although a 5-point scale might be adequate, people may routinely make more fine-grained distinctions. For example, most people may be able to differentiate feeling slightly favorable, moderately favorable, and extremely favorable toward objects…

Similarly, Alwin and Krosnick (1991, 149) contend that people have "weak, moderate, and strong feelings toward attitude objects", suggesting that five or fewer response options are often insufficient to capture the range of variability in agreement or disagreement to a statement. These findings, while interpreted by their authors in favor of a seven-point scale, more appropriately indicate that a six- or seven-point scale is optimal, depending on whether a scale mid-point should be included or not. Furthermore, my interviews revealed that while no one I spoke to or heard about was truly neutral on the issue of shale gas development, there was a range of variation in support and opposition for development.

More researchers than not include mid-points on Likert-style scales to provide respondents with the option of being "neutral" in the case that they actually do not agree or disagree with the statement. Alwin and Krosnick (1991) provide evidence that offering a mid-point can increase instrument reliability in cases where respondents truly have no valence on an issue; they suggest that in the absence of a mid-point *satisficing* can occur. Satisficing is a process by which respondents develop a heuristic approach to answering questions, which could include picking an option a respondent thinks the interviewer desires. Under satisficing, responses are given based on reducing cognitive effort, rather than being based on the respondent's preferences.

Satisficing can also occur *due to* the presence of a mid-point. If respondents have genuine preferences, but ones that are not strongly articulated, a mid-point can heuristically lead them to opt for the simpler answer by selecting the "neutral" response option (Krosnick and Presser 2010). Several methodological studies have shown that

mid-point response options are more attractive to people who see the issue as less important or who have less interest in the topic (Bishop 1990, Krosnick and Schuman 1988, O'Muircheartaigh *et al.* 1999). This association is problematic because an issue's lack of importance, or one's lack of interest in an issue, does not equate to neutrality. Neutrality is the mid-point on a scale that measures one's convictions on an issue (e.g., whether one agrees or disagrees). On the other hand, beliefs about importance of and interest in an issue are measures of the level of assuredness of those convictions (i.e., the degree to which that issue is even something worth considering). Therefore, midpoints may offer a response option with low validity.

The inability to determine clearly what a respondent means when he/she selects a mid-point response option led me to exclude such an option in the majority of scale questions in my survey. Krosnick and Presser (2010, 269) enumerate three essential components of a well-designed scale: (1) the number and labels of the points offered cover the full range of potential response options, (2) response options should be ordinal and not overlap, and (3) respondents must have "a precise and stable understanding of the meaning of each point on the scale". Use of a mid-point can violate the second component. If a respondent's use of the mid-point can be interpreted as potentially a commentary on the relevance of the topic, as opposed to a valenced response to a specific question, the requirement that response options be ordinal is not upheld. This makes questionable the use of basic descriptive statistics, such as the mean, to characterize the resulting data.

A final topic I considered when designing my survey was whether or not to include a "no opinion" or "don't know" response option. Similar to the "neutral" option, a "don't know" response option can lead to heuristic reliance on this category, reducing the percentage of interval data that can be meaningfully compared with multivariate statistics. Nonetheless, some researchers argue that this response category is necessary for the purposes of reliability in case respondents truly are not informed on a topic and do

not have an opinion. Krosnick (1999), however, reviews numerous studies that indicate that "no opinion" and "don't know" response options do not increase data reliability, do not increase the strength of associations between variables, and do not reduce systematic measurement error. Additionally, due to unsystematic variation consistently exhibited in such responses within surveys by individual respondents, these categories do not clearly represent respondents lacking opinions on a given topic (as they are intended to). The "no opinion" and "don't know" response options seem methodologically most relevant in cases where the survey audience lacks knowledge about an issue. My content analysis and interviews suggested that this would be far from the case in my survey communities. In other geographical contexts (e.g., a nation-wide USA survey), this response category could be appropriate.

2. Survey administration

I finished designing my survey in late July 2013. At this same time, I was working with a marketing firm (MSG – Marketing Systems Group) to identify and purchase a random sample of names, addresses, and telephone numbers for residents in my municipalities. MSG compiled the sample by cross-referencing the most recently available US Postal Service records with telephone book white pages. I was able to exclude seasonal addresses, addresses that had been vacant for over 90 days, and "drops" (single delivery points that service multiple residences) from the sample. I included all other address types (i.e., regular street addresses, PO Boxes, street addresses that actually go to PO Boxes, rural routes, and deliveries contracted out to third parties by the USPS).

The first wave of surveys was mailed with a cover letter on 4 September 2013 (see Appendix F for the letter). The first follow-up reminder was mailed one week later. On 25 September 2013, an additional survey and new cover letter was mailed to every household in the sample that had not yet responded or been returned as undeliverable. One week later, the final reminder was mailed. As surveys were returned, a staff member in the Human Dimensions

Research Unit, Department of Natural Resources, Cornell University, entered all the data into SPSS. I created a coding scheme and reviewed it with the staff member in advance of data entry. I collected surveys until mid-November, when I closed data collection.

3. Follow up via drop-off, pick-up method

My response rates varied considerably across municipalities and were particularly low in several of the more densely populated areas (as low as a twelve percent response rate in a couple communities). This was not surprising because the extraction stage of the shale gas development process has less potential to effect people living in densely populated areas; nonetheless, I felt it important to gauge these individuals' representations of shale gas development. Many urban-dwelling individuals are heavily involved in the discourse on shale gas development and help to shape the policy process on this issue.

In an attempt to increase response rates, I implemented "the drop-off and pick-up method" as a means of follow-up in three municipalities in NY (Binghamton, Cortland, and Deposit) and three in PA (Athens borough, Athens township, and Towanda) (Allred and Ross-Davis 2011). I randomly selected approximately thirty addresses of residents who had not yet responded in each of these municipalities and, in early November 2013, drove to each address to drop off a survey and cover letter in person (see Appendix G for the cover letter). I knocked on the door and asked the resident if he/she had received the survey. If he/she had, I asked if there was any reason he/she had not responded yet and then requested that he/she fill out the new copy. I stated that I would either return to pick it up in three days (he/she could leave it by the front door), or he/she could place it in the mail (the surveys had pre-paid metered postage on the back); I asked each resident for his/her preference.

If a resident did not recall receiving the survey, I briefly explained the purpose of the survey and asked him/her to complete it. If no one answered the door, I left the survey and cover letter in a clear plastic bag on the handle of the front door; the letter stated that I would return in three days to collect the survey (he/she could put it back in the bag on the door handle). When I

returned in three days, if a survey was not filled out and hanging on the door, I knocked on the door to inquire about the survey. If no one answered, I left another reminder letter and asked the resident to place the survey in the mail.

This application of the drop-off and pick-up method increased response rates in the municipalities where I implemented it. Additionally, it was relatively easy to undertake in urbanized areas, due to houses/apartments being close together. (I was able to walk between several addresses where I dropped off surveys in the village and boroughs I visited; addresses in the cities and township were more spread out). This method increased the total number of responses in the municipalities by the following percentages: Binghamton – 29%, Cortland – 41%, Deposit – 33%, Athens (borough) – 32%, Athens (township) – 35%, and Towanda – 68%.

4. Survey response rate

After collecting the foregoing follow-up surveys, I calculated the overall response rate for the survey. The survey was mailed to 4,998 households; 629 of those surveys were returned as undeliverable (345 in NY and 284 in PA). Therefore, with 1202 respondents (637 from NY and 565 from PA), the adjusted response rate for the entire sample was 27.5%. The rate for the NY municipalities was 29.6%; the rate for the PA municipalities was 25.5%. The adjusted response rates for the individual municipalities varied considerably, with Candor, NY, having the highest (39.6%) and Williamsport, PA, having the lowest (12.3%).

5. Non-respondent telephone follow-up

Best practice for survey research dictates that researchers conduct a non-respondent follow-up, after closure of data collection, to compare respondents and non-respondents for differences on key variables. In July 2013, I contracted with Cornell University's Survey Research Institute (SRI) to conduct a telephone non-respondent follow up survey, to occur following collection of the primary data. SRI conducted these telephone interviews in late November 2013.

The non-respondent follow-up sample included 75 completed interviews each from residents in NY and residents in PA. I incorporated a sub-set of the questions from the original survey in this follow-up survey; I selected 12 questions that included 29 individual variables (for comparison, the original survey contained 168 variables across 28 questions). The questions in the follow-up survey measured key demographic characteristics, perspectives on major SR of shale gas development, engagement in fora for emergence of SR, and individual- and societal-level factors leading to development of SR. I was able to view the results for the first ~500 responses to the survey before needing to finalize the variables for the follow-up survey. This allowed me to select questions for inclusion that would be particularly important for the multivariate analyses I intended to conduct. I discuss the results of this non-respondent follow-up, in comparison to the findings from the survey respondents, in Chapter Six.

6. Data analysis

For my initial analysis of the data from the 1202 survey respondents, I reviewed the frequencies and means for all 168 variables in the survey. After examining individual results and patterns, I conducted factor analyses and computed reliability statistics for each question area that contained multiple related measures (i.e., beliefs about impacts of shale gas development, beliefs about importance of sustainability/resilience, and beliefs about ethical rationales for decision making on shale gas development). I then conducted a series of multiple regression analyses, testing for relationships I had hypothesized based on my previous data collection and social representations theory. Next, I compared SR across communities, using a generalized linear model with a normal probability distribution, an identity link function, and sequential Bonferroni corrections for multiple comparisons. This allowed me to test for statistically significant differences in SR between communities.

Of the 168 variables in the survey, 163 were close-ended, with between 2-7 response options. Four of the five open-ended questions asked for numerical data (i.e., year born, number of years lived in the community, number of generations family has been in the community, and

acres of land owned). The final open-ended question was the word association task. This question required additional analysis before it could be examined through the aforementioned descriptive and multivariate analyses. I developed a coding scheme for SR of shale gas development that I thought, *a priori*, respondents might write in for their response to this question. This initial set of codes was based on SR that emerged as important through my content analysis, interviews, and field visits to the communities.

I further refined my coding scheme as I read through the answers that my respondents provided (see Appendix H for the final coding scheme). I also honed this coding scheme by working with a colleague (Professor Chris Clarke, George Mason University) who was simultaneously coding open-ended responses to a similar question in two additional surveys on which we collaborated. After I coded all the responses, Professor Clarke coded 10% of the sample (120 articles), allowing for an inter-coder reliability analysis. We established at least 80% agreement on all codes and achieved a Krippendorf's alpha of at least 0.8 for all codes. We reconciled all conflicting codes. Once coding and the reliability analysis were complete, I was able to include these data in all my other statistical analyses, treating reference or lack of reference to particular SR as a categorical variable.

While I was able to conduct all of the aforementioned analyses in SPSS Statistics, I relied on M*plus* software for my more complex statistical analyses. To model the factor analyses and multiple regression analyses simultaneously, I constructed several structural equation models that tested how well the survey data fit my hypothesized connections between variables. After establishing adequate fit for these models, I added secondary data I collected on each municipality to the model (e.g., see the statistics in Table 3.6).

I then constructed two-level structural equation models that simultaneously accounted independently for the effects of societal-level characteristics (i.e., secondary data measured at the community level) and individual-level characteristics (i.e., data from my survey). Multilevel structural equation modeling allows the researcher to "summarize within-group variability at the individual level and between-group variability at the group level" (Byrne 2012, 346). Rabe-

Hesketh and colleagues (2004) assert that "multilevel structural equation models [are] required when the units of observation form a hierarchy of nested clusters and some variables of interest cannot be measured directly but are measured by a set of items". This approach is needed to control appropriately for measurement error and sampling error (Marsh *et al.* 2009).

If a researcher were to aggregate all individual level data to produce means (averages), which he could then use for a between-groups analysis, this would mask potentially meaningful relationships at the within-group level (in the case of my data, group equals community). It could also introduce potential for serious error by making relationships between groups appear stronger than they actually are due to the mean statistics eliminating within-group variability (Bovaird 2007, Byrne 2012). Disaggregating data at the group level for statistical analyses at the individual level (e.g., using the same community-level value for each individual respondent in that community) is equally, if not more problematic. Disaggregation violates two assumptions necessary for most statistical analysis: "(a) that all observations are independent, and (b) that all random errors are independent, normally distributed, and homoscedastic" (Byrne 2012, 347). This approach to combining individual and group level data can, therefore, lead to underestimated standard errors and an increased likelihood of "false positive" (type I error) determinations (Bovaird 2007).

To properly account for variability at both levels of analysis and to adequately represent the standard error in the data, multilevel modeling is needed. My two-level analysis of differences between communities based on individual- and societal-level data required structural equation modeling due to my inclusion of latent variables (variables that were not measured directly, but through multiple factors). The multilevel structural equation modeling allowed me to test the degree to which factors measured at the individual- and societal-level helped to predict SR of shale gas development.

Chapter Four: Newspaper Content Analysis

"A newspaper is not just for reporting the news as it is, but to make people mad enough to do something about it."
-- Mark Twain

"Four hostile newspapers are more to be feared than a thousand bayonets."
-- Napoléon Bonaparte

I. Introduction

I began my data collection with a content analysis of regional newspaper coverage mentioning "Marcellus Shale". I sought to develop an initial understanding of social representations (SR) of shale gas development. If the newspaper coverage predominantly reflects public discourse, it could help spread emerging anchors for SR. If the newspapers report findings and perspectives novel to local discourse about gas development, the coverage itself could be the public forum in which potential anchors are debated and selected. In addition to anchoring, newspaper coverage – through frequently repeated language and/or vivid imagery – can play a role in objectifying shale gas development. Mark Twain and Napoleon both understood the power of the press to engrain representations in the minds of members of the public. The sources I analyzed offered representations to partisans and non-partisans alike.

I begin this chapter with an overview of the major variables I coded for in my content analysis, their relation to SR, and their relative frequency in the newspaper articles. Next, I examine in-depth the impacts mentioned and valences assigned to impacts in the articles; I test for differences across the four newspapers. Third, I present results from a series of correspondence analyses that explore relationships between categories of impacts mentioned (i.e., environmental, economic, social), valence assigned (i.e., positive, negative, neutral, mixed), and newspaper (i.e., Binghamton, Elmira, Scranton, Williamsport).

Fourth, I shift away from differences between newspapers to differences over time. I introduce several generalized linear models that jointly characterize the degree to which

representations shifted over the five years included in the content analysis (2008-2012). Following these comparisons, I present data from interviews I conducted with the journalists who wrote the most articles on shale gas development at each newspaper. Their perspectives provide some explanations for why certain impacts were mentioned more frequently than others, for differences between newspapers, and for variation over time. I end by providing logistic regression models that shed light on claims made by the journalists. These models examine the effect of sources cited within articles on impacts mentioned and valence assigned.

II. Variables Included in the Content Analysis

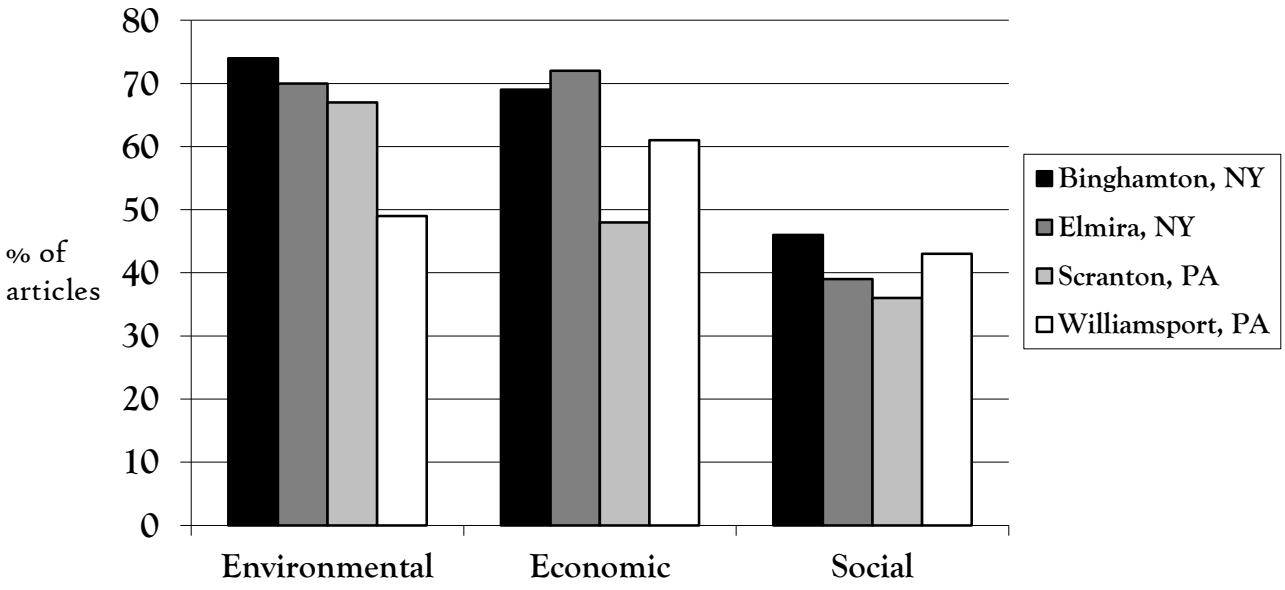
I read several newspaper articles before any coding – to familiarize myself with the types of codes that could be relevant. I included an expansive number of items in my coding scheme (see Appendix B). Most codes were in three main areas: impacts of shale gas development, valence attributed to each impact, and sources cited as providing information on shale gas development. I included impacts and valences because these emerged early on in my reading (before coding) as key representations of shale gas development. They seemed to be major ways in which the newspaper articles, or specific sources in the articles, characterized shale gas development and its effects. Impacts also have been cited consistently in research on public perceptions of shale gas development as an important way of describing beliefs about this topic (Braiser *et al.* 2011, Jacquet and Stedman 2013, Kriesky *et al.* 2013, Ladd 2013, Schafft *et al.* 2013, Theodori 2009, Theodori 2013, Wynveen 2011). I coded for sources cited in the articles because this is one way of describing the fora in which SR emerge. Although the newspaper itself is a public forum in which SR are discussed, the articles identify other fora as well.

III. Impacts Discussed, and Differences Across Newspapers

Across all newspapers, environmental and economic impacts were mentioned frequently, with noticeably less coverage of environmental impacts in the Williamsport newspaper and less

coverage of economic impacts in the Scranton newspaper (Figure 4.1).[6] Social impacts were mentioned infrequently, with no newspaper clearly presenting more or less coverage in this category than any other.[7]

Figure 4.1: Comparison of categories of impacts across regional newspapers



A. Environmental impacts

By a wide margin, the most frequently mentioned environmental impact in each newspaper was effects on water quality (Table 4.1). This impact was a combination of three separate impacts for which I coded (drinking water quality, quality of streams/rivers/lakes, and references to "water quality" that did not specify the water source). In the Binghamton, Elmira, and Scranton papers, references to effects on drinking water quality were by far the most

[6] A Riffe's Z-test for differences in proportions reveals that Williamsport (W, from here forward) mentioned environmental impacts significantly less often than all the other papers (z-scores of -6.80, -5.38, and -4.86 for comparisons with Binghamton [B], Elmira [E], and Scranton [S]; $p < 0.001$ for all three pairwise comparisons). Riffe's Z for economic impacts at S compared to B, E, and W: -5.40, -6.04, -3.44 ($p < 0.001$ for all).

[7] Most Riffe's Z comparisons were non-significant, however, S cited a smaller percentage of social impacts than B ($z = -2.52$, $p < 0.01$) and W ($z = -1.88$, $p < 0.05$), and E cited a smaller percentage of social impacts than B ($z = -1.65$, $p < 0.05$).

common of the three sub-impacts; in the Williamsport paper, references to all three types of water quality were equal. The Williamsport paper had a significantly smaller percentage of articles that focused on water quality, compared to the other papers.[8]

The second most commonly mentioned environmental impact in each paper was "non-specific" references to environmental impacts. I used this code for any reference to an environmental impact without further information. For example, many articles stated that a goal of regulation of shale gas development is to balance the potential for negative environmental impacts with opportunities for economic growth, but did not offer any clarification of what specific impacts may exist. Non-specific references were far more common in the NY newspapers, compared to the PA papers.[9]

The most notable characteristic of the other thirteen environmental impacts presented in Table 4.1 is that all these impacts are mentioned relatively infrequently, compared to water quality and non-specific environmental concerns. Of the fifteen environmental impacts (treating all effects on water quality as a single impact), only three impacts appeared in more than 10% of coverage across the entire sample.

Table 4.1: Frequency of environmental impacts mentioned in regional newspaper coverage

	Binghamton	**Elmira**	**Scranton**	**Williamsport**	**TOTAL**
ANY effect on water quality* (all of the next 3 codes)	132 **(45.5%)**	110 **(44.0%)**	130 **(40.2%)**	99 **(27.2%)**	471 **(38.4%)**
Drinking water*	88 **(30.3%)**	69 **(27.6%)**	87 **(26.9%)**	40 **(11.0%)**	284 **(23.1%)**
Streams, rivers, and lakes	24 **(8.3%)**	34 **(13.6%)**	46 **(14.2%)**	42 **(11.5%)**	146 **(11.9%)**
Water quality (w/o further specificity)	44 **(15.2%)**	29 **(11.6%)**	32 **(9.9%)**	39 **(10.7%)**	144 **(11.7%)**

[8] Riffe's Z for W, compared to B, E, and S: -5.08 ($p < 0.001$), -4.35 ($p < 0.001$), and -3.63 ($p < 0.01$).
[9] Riffe's Z for B, compared to S and W: 4.09, 4.85 ($p < 0.001$ for both); Riffe's Z for E, compared to S and W: 3.54, 4.30 ($p < 0.001$ for both); NS z-statistics between B and E (0.51), and between S and W (0.71).

Non-specific environmental impacts*	90 **(31.0%)**	73 **(29.2%)**	55 **(17.0%)**	55 **(15.1%)**	273 **(22.2%)**
Wastewater (creation, disposal)	47 **(16.2%)**	34 **(13.6%)**	36 **(11.1%)**	36 **(9.9%)**	153 **(12.5%)**
Methane migration*	23 **(7.9%)**	19 **(7.6%)**	36 **(11.1%)**	6 **(1.6%)**	84 **(6.8%)**
Water supply (availability)	24 **(8.3%)**	17 **(6.8%)**	20 **(6.2%)**	22 **(6.0%)**	83 **(6.8%)**
Air quality	17 **(5.9%)**	21 **(8.4%)**	19 **(5.9%)**	16 **(4.4%)**	73 **(5.9%)**
Land‡ (not specific to forests or soil)	17 **(5.9%)**	21 **(8.4%)**	12 **(3.7%)**	12 **(3.3%)**	62 **(5.1%)**
Wildlife	6 **(2.1%)**	10 **(4.0%)**	16 **(5.0%)**	13 **(3.6%)**	45 **(3.7%)**
Clean energy	11 **(3.8%)**	13 **(5.2%)**	4 **(1.2%)**	16 **(4.4%)**	44 **(3.6%)**
Radioactivity‡ (problems due to)	16 **(5.5%)**	8 **(3.2%)**	6 **(1.9%)**	7 **(1.9%)**	37 **(3.0%)**
Forests*	2 **(0.7%)**	2 **(0.8%)**	20 **(6.2%)**	8 **(2.2%)**	32 **(2.6%)**
Soil quality	10 **(3.4%)**	6 **(2.4%)**	7 **(2.2%)**	9 **(2.5%)**	32 **(2.6%)**
Solid waste (issues due to production of)	3 **(1.0%)**	3 **(1.2%)**	9 **(2.8%)**	3 **(0.8%)**	18 **(1.5%)**
Greenhouse gas emissions	6 **(2.1%)**	2 **(0.8%)**	7 **(2.2%)**	3 **(0.8%)**	18 **(1.5%)**
Earthquakes (potential for)	1 **(0.3%)**	1 **(0.4%)**	0 **(0.0%)**	3 **(0.8%)**	5 **(0.4%)**

Note: This table and the following tables in this section reveal the raw number and percentage of newspaper articles that cited each impact for which I coded.
* ANOVA comparing percentages across newspapers is significant at $p < 0.001$
‡ ANOVA significant at $p < 0.05$

B. Economic impacts

Representations of economic impacts were more varied across the four newspapers than representations of environmental impacts. The Williamsport paper dominated in percentage of articles referencing jobs and local business,[10] while the NY papers led in percentage of articles

[10] Riffe's Z for W, compared to B, E, and S on jobs: 3.07 ($p < 0.001$), 1.70 ($p < 0.05$), 4.99 ($p < 0.001$); Riffe's Z for W, compared to B, E, and S on local business: 2.97 ($p < 0.001$), 1.95 ($p < 0.05$), 4.12 ($p < 0.001$).

that mentioned non-specific economic impacts[11] and personal income from leases/royalties[12] (Table 4.2). Of the eleven economic impacts (treating leases and royalties as a combined impact), only three appeared in over 10% of all coverage (i.e., jobs, leases and/or royalties, and non-specific economic effects). No specific economic impact received attention in more than 14 percent of articles from the Scranton sample.

Table 4.2: Frequency of economic impacts mentioned in regional newspaper coverage

	Binghamton	**Elmira**	**Scranton**	**Williamsport**	**TOTAL**
Jobs*	51 **(17.6%)**	56 **(22.4%)**	43 **(13.3%)**	101 **(27.7%)**	251 **(20.5%)**
Leases and/or Royalties*	94 **(32.4%)**	84 **(33.6%)**	44 **(13.6%)**	26 **(7.1%)**	248 **(20.2%)**
Leases*	81 **(27.9%)**	71 **(28.4%)**	35 **(10.8%)**	21 **(5.8%)**	208 **(17.0%)**
Royalties*	45 **(15.5%)**	43 **(17.2%)**	26 **(8.0%)**	13 **(3.6%)**	127 **(10.4%)**
Non-specific economic impacts*	81 **(27.9%)**	58 **(23.2%)**	42 **(13.0%)**	67 **(18.4%)**	248 **(20.2%)**
Local business*	20 **(6.9%)**	22 **(8.8%)**	17 **(5.3%)**	51 **(14.0%)**	110 **(9.0%)**
Tax revenue	20 **(6.9%)**	15 **(6.0%)**	33 **(10.2%)**	28 **(7.7%)**	96 **(7.8%)**
Cheap energy	12 **(4.1%)**	6 **(2.4%)**	10 **(3.1%)**	14 **(3.8%)**	42 **(3.4%)**
Housing costs* (rent)	4 **(1.4%)**	4 **(1.6%)**	6 **(1.9%)**	24 **(6.6%)**	38 **(3.1%)**
Taxpayer costs	13 **(4.5%)**	9 **(3.6%)**	10 **(3.1%)**	4 **(1.1%)**	36 **(2.9%)**
Property values	9 **(3.1%)**	9 **(3.6%)**	8 **(2.5%)**	9 **(2.5%)**	35 **(2.9%)**
Tourism	3 **(1.0%)**	5 **(2.0%)**	2 **(0.6%)**	4 **(1.1%)**	14 **(1.1%)**
Other Economic impacts (anything not listed above)	2 **(0.7%)**	5 **(2.0%)**	8 **(2.5%)**	5 **(1.4%)**	20 **(1.6%)**

[11] Riffe's Z for B, compared to S and W: 4.64, 3.01 ($p < 0.001$ for both); Riffe's Z for E, compared to S and W: 3.07 ($p < 0.001$), 1.50 (NS); NS z-score between B and E (1.34), $p < 0.05$ between S and W (-1.82).

[12] Riffe's Z for B, compared to S and W: 5.37, 8.20 ($p < 0.001$ for both); Riffe's Z for E, compared to S and W: 5.61, 8.23 ($p < 0.001$ for both); NS z-score between B and E (-0.49), $p < 0.001$ between S and W (2.98).

* ANOVA significant at $p < 0.001$

C. Social impacts

Discussion of social impacts was limited across all four newspapers (Table 4.3). Of the sixteen distinct social impacts (treating effects on roads and infrastructure as a combined impact), only three surfaced in more than 5% of all coverage (i.e., traffic, roads and/or infrastructure, and public health). No social impact was mentioned in more than 13% of coverage across all newspapers and no single impact was mentioned in more than 18% of articles within any particular newspaper.

Discussion of social impacts was most pronounced overall in the Binghamton and Williamsport newspapers, although Williamsport had the lowest percentage of articles that addressed effects on community character (e.g., changes in the rural nature of a community, peace in a community, quality of life, ability to keep children in the community, or shifting demographic composition of the community)[13]. Nevertheless, Williamsport had the highest percentage of articles that mentioned impacts on roads and infrastructure[14]. Once again, few articles from the Scranton newspaper discussed any impacts in this category, relative to the other newspapers. Some social impacts were mentioned in a significantly greater percentage of NY coverage, such as impacts on public health[15] and noise (from trucks and drilling rigs)[16].

[13] Riffe's Z for W, compared to B, E, and S: -2.62 ($p < 0.001$), -2.32 ($p < 0.01$), -2.07 ($p < 0.01$).
[14] Riffe's Z for W, compared to B, E, and S: 1.43 (NS), 2.43 ($p < 0.01$), 2.51 ($p < 0.01$).
[15] Riffe's Z for B, compared to S and W: 2.85, 4.19 ($p < 0.001$ for both); Riffe's Z for E, compared to S and W: 2.41 ($p < 0.01$), 3.66 ($p < 0.001$); NS z-scores between B and E (0.31), and between S and W (1.40).
[16] Riffe's Z for B, compared to S and W: 3.36, 4.21 ($p < 0.001$ for both); Riffe's Z for E, compared to S and W: 2.72, 3.62 ($p < 0.001$ for both); NS z-scores between B and E (0.66), and between S and W (1.12).

Table 4.3: Frequency of social impacts mentioned in regional newspaper coverage

	Binghamton	**Elmira**	**Scranton**	**Williamsport**	**TOTAL**
Public health* (also family, personal)	51 **(17.6%)**	43 **(17.2%)**	31 **(9.6%)**	27 **(7.4%)**	152 **(12.4%)**
Roads and/or Infrastructure*	34 **(11.7%)**	21 **(8.4%)**	27 **(8.4%)**	65 **(17.9%)**	147 **(12.0%)**
Roads†	29 **(10.0%)**	18 **(7.2%)**	19 **(5.9%)**	50 **(13.7%)**	116 **(9.5%)**
Infrastructure (e.g., bridges, buildings)	14 **(4.8%)**	6 **(2.4%)**	11 **(3.4%)**	22 **(6.0%)**	53 **(4.3%)**
Traffic‡	17 **(5.9%)**	19 **(7.6%)**	13 **(4.0%)**	35 **(9.6%)**	84 **(6.8%)**
Community services† (police, fire)	7 **(2.4%)**	7 **(2.8%)**	15 **(4.6%)**	29 **(8.0%)**	58 **(4.7%)**
Energy independence (from other nations)	18 **(6.2%)**	8 **(3.2%)**	9 **(2.8%)**	21 **(5.8%)**	56 **(4.6%)**
Noise*	24 **(8.3%)**	17 **(6.8%)**	7 **(2.2%)**	4 **(1.1%)**	52 **(4.2%)**
Public safety (crime, pedestrian safety)	7 **(2.4%)**	13 **(5.2%)**	14 **(4.3%)**	18 **(4.9%)**	52 **(4.2%)**
Community character‡	16 **(5.5%)**	13 **(5.2%)**	14 **(4.3%)**	6 **(1.6%)**	49 **(4.0%)**
Non-specific social impacts	10 **(3.4%)**	9 **(3.6%)**	6 **(1.9%)**	4 **(1.1%)**	29 **(2.4%)**
Housing availability*	2 **(0.7%)**	4 **(1.6%)**	2 **(0.6%)**	19 **(5.2%)**	27 **(2.2%)**
Aesthetic beauty	7 **(2.4%)**	2 **(0.8%)**	4 **(1.2%)**	4 **(1.1%)**	17 **(1.4%)**
Outdoor recreation (quality, opportunities)	2 **(0.7%)**	1 **(0.4%)**	6 **(1.9%)**	4 **(1.1%)**	13 **(1.1%)**
Dust (from trucks, industry)	6 **(2.1%)**	3 **(1.2%)**	2 **(0.6%)**	1 **(0.3%)**	12 **(1.0%)**
Light pollution†	6 **(2.1%)**	1 **(0.4%)**	0 **(0.0%)**	0 **(0.0%)**	7 **(0.6%)**
Distribution (of wealth, gains, loses)	3 **(1.0%)**	1 **(0.4%)**	1 **(0.3%)**	0 **(0.0%)**	5 **(0.4%)**
Other social impacts‡ (anything not listed above)	4 **(1.4%)**	11 **(4.4%)**	6 **(1.9%)**	5 **(1.4%)**	26 **(2.1%)**

* ANOVA comparing percentages across newspapers is significant at $p < 0.001$
† ANOVA significant at $p < 0.01$
‡ ANOVA significant at $p < 0.05$

IV. Valences Assigned to Impacts; Differences Across Newspapers

The valence of impacts within a newspaper article (positive, negative, neutral, or mixed [i.e., positive and negative]) emerged as an important representation. The extent to which shale gas development is positive or negative manifest itself in the newspaper coverage as a representation in its own right (i.e., valence, independent of impacts, was a way in which some sources cited in the articles discussed shale gas development). Nevertheless, even more common was association of a valence with particular impacts. The valence and impact combined to form a full SR (e.g., "negative environmental impacts" or "positive economic impacts").

I initially coded the valence of each impact within each article (i.e., positive, negative, neutral, or mixed [positive and negative]); I then aggregated all valences within categories of impacts within each article (i.e., environmental, economic, and social impacts). Finally, I aggregated impacts across all three categories to generate an overall valence for each article. In the tables below, I present the total number of occurrences and percentage for each valence in each category of impacts (i.e., environmental, economic, and social). I also combine valence statistics across all categories for the entire sample and for each newspaper.

Table 4.4: Frequency of valences for environmental impacts in newspaper coverage*

	Binghamton	**Elmira**	**Scranton**	**Williamsport**	**TOTAL**
Positive‡	3 **(1.0%)**	1 **(0.4%)**	3 **(0.9%)**	11 **(3.0%)**	18 **(1.5%)**
Negative*	178 **(58.6%)**	142 **(56.8%)**	161 **(49.8%)**	126 **(34.6%)**	599 **(48.8%)**
Neutral	27 **(9.3%)**	16 **(6.4%)**	32 **(9.9%)**	23 **(6.3%)**	98 **(8.0%)**
Mixed	12 **(4.1%)**	16 **(6.4%)**	13 **(4.0%)**	14 **(3.8%)**	55 **(4.5%)**

Percentages listed here (and in the following three tables) reflect the percentage of *all* articles that included valences of the specified type (as opposed to percentage of articles mentioning a specific impact that included a particular valence).

* ANOVA comparing percentages across newspapers is significant at $p < 0.001$

‡ ANOVA significant at $p < 0.05$

Table 4.5: Frequency of valences for economic impacts in newspaper coverage

	Binghamton	**Elmira**	**Scranton**	**Williamsport**	**TOTAL**
Positive*	125 **(43.1%)**	108 **(43.2%)**	79 **(24.5%)**	172 **(47.3%)**	484 **(39.4%)**
Negative	10 **(3.4%)**	12 **(4.8%)**	20 **(6.2%)**	11 **(3.0%)**	53 **(4.3%)**
Neutral*	34 **(11.7%)**	42 **(16.8%)**	42 **(13.0%)**	21 **(5.8%)**	139 **(11.3%)**
Mixed‡	29 **(10.0%)**	17 **(6.8%)**	13 **(4.0%)**	18 **(4.9%)**	77 **(6.3%)**

* ANOVA comparing percentages across newspapers is significant at $p < 0.001$
‡ ANOVA significant at $p < 0.05$

Table 4.6: Frequency of valences for social impacts in newspaper coverage [a]

	Binghamton	**Elmira**	**Scranton**	**Williamsport**	**TOTAL**
Positive	8 **(2.8%)**	6 **(2.4%)**	8 **(2.5%)**	17 **(4.7%)**	39 **(3.2%)**
Negative	94 **(32.4%)**	72 **(28.8%)**	73 **(22.6%)**	98 **(26.9%)**	337 **(27.5%)**
Neutral	17 **(5.9%)**	13 **(5.2%)**	24 **(7.4%)**	26 **(7.1%)**	80 **(6.5%)**
Mixed	10 **(3.4%)**	6 **(2.4%)**	9 **(2.8%)**	16 **(4.4%)**	41 **(3.3%)**

[a] All ANOVA tests comparing percentages across newspapers are *non-significant*; $p > 0.05$

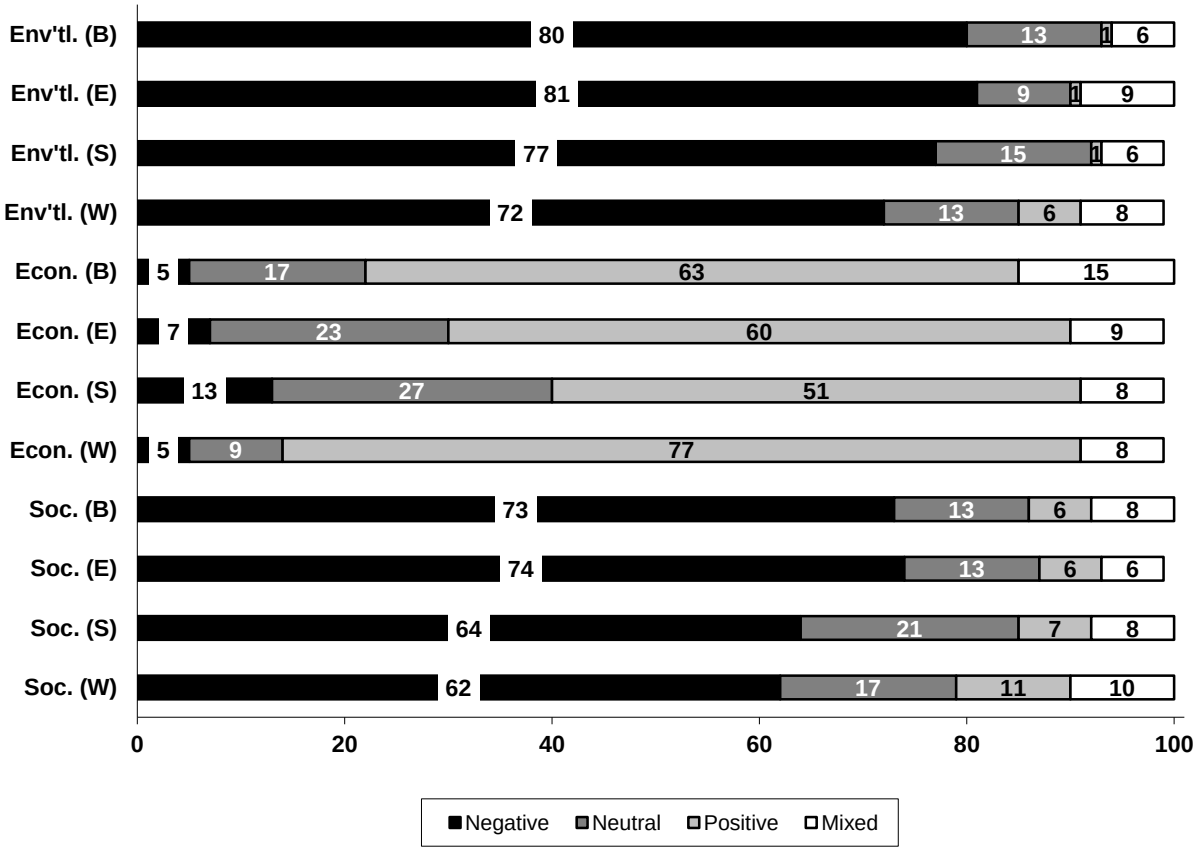
Table 4.7: Frequency of valences across all impacts in newspaper coverage.

	Binghamton	**Elmira**	**Scranton**	**Williamsport**	**TOTAL**
Positive*	31 **(10.7%)**	21 **(8.4%)**	33 **(10.2%)**	98 **(26.9%)**	183 **(14.9%)**
Negative*	80 **(27.6%)**	65 **(26.0%)**	127 **(39.3%)**	89 **(24.5%)**	361 **(29.4%)**
Neutral‡	31 **(10.7%)**	30 **(12.0%)**	57 **(17.6%)**	37 **(10.2%)**	155 **(12.6%)**
Mixed*	128 **(44.1%)**	110 **(44.0%)**	71 **(22.0%)**	104 **(28.6%)**	413 **(33.7%)**

* ANOVA comparing percentages across newspapers is significant at $p < 0.001$
‡ ANOVA significant at $p < 0.05$

In Figure 4.2 (below), I summarize valence across all newspapers and impacts categories. Here, unlike in Tables 4.4-4.7, I report only on the articles that mentioned a particular category of impact (e.g., from the Binghamton sample of 290 articles, only 215 mention environmental impacts, 200 mention economic impacts, and 132 mention social impacts; therefore, the following data is based on those sample sizes, not 290).

Figure 4.2: Valence of impacts in regional newspaper coverage on "Marcellus Shale"*



Env'tl. = Environmental, Econ. = Economic, Soc. = Social
B = Binghamton (NY), E = Elmira (NY), S = Scranton (PA), and W = Williamsport (PA)

The numbers and sizes of the bars indicate the percentage of articles from each newspaper sample that contained each valence. The total 100% for each bar is based on the number of articles that mentioned a particular category of impact (i.e., environmental, economic, or social) for that newspaper sample.

A. Environmental impact valences

The vast majority of environmental impacts across all newspapers were negatively valenced; the next largest proportion of environmental impacts in each paper had neutral valences (Figure 4.2). While the percentage of articles with positively valenced environmental impacts is minimal in each newspaper, Williamsport had a significantly higher percentage of such articles than the other papers.[17] Williamsport also had a lower percentage of negatively valenced articles than the other three papers.[18]

B. Economic impact valences

A majority of the articles afforded a positive valence to economic impacts; nonetheless, the Williamsport articles exhibited positive valence significantly more than the articles from the other papers.[19] Williamsport also had a much lower percentage of articles with a neutral economic valence, compared to the other newspapers.[20] Scranton exhibited the highest percentage of articles with negative economic impacts[21] and the smallest percentage of articles positive economic impacts.[22]

C. Social impact valences

A large majority of the social impacts discussed in each paper had a negative valence, although not quite as large a percentage of articles as for environmental impacts. The NY newspapers contained a higher percentage of negatively-valenced articles than the PA newspapers [23].

[17] Riffe's Z for W, compared to B, E, and S: 2.60 ($p < 0.001$), 2.56 ($p < 0.01$), 2.59 ($p < 0.001$)
[18] Riffe's Z for W, compared to B, E, and S: -1.83 ($p < 0.05$), -1.99 ($p < 0.05$), -1.12 (NS)
[19] Riffe's Z for W, compared to B, E, and S: 3.15, 3.68, 5.29 ($p < 0.001$ for all)
[20] Riffe's Z for W, compared to B, E, and S: -2.43 ($p < 0.01$), -3.80 ($p < 0.001$), -4.43 ($p < 0.001$)
[21] Riffe's Z for S, compared to B, E, and W: 2.56 ($p < 0.01$), 1.81 ($p < 0.05$), 2.60 ($p < 0.001$)
[22] Riffe's Z for S compared to B, E, and W: -2.27 ($p < 0.01$), -1.65 ($p < 0.05$), -5.29 ($p < 0.001$)
[23] Riffe's Z for B, compared to S and W: 1.51 (NS), 2.00 ($p < 0.01$); Riffe's Z for E, compared to S and W: 1.58 (NS), 2.03 ($p < 0.01$)

V. Sources Cited, and Differences Across Newspapers

The third and final major set of variables for which I coded was the sources cited in the articles as providing information on shale gas development. Table 4.8 reveals the total number and percentage of articles that cited each type of information source, for the entire sample and for each newspaper.

Table 4.8: Frequency of sources cited as providing information on shale gas development.

	Binghamton	**Elmira**	**Scranton**	**Williamsport**	**TOTAL**
State politician	68 **(23.4%)**	51 **(20.4%)**	59 **(18.3%)**	68 **(18.7%)**	246 **(20.0%)**
NY DEC / PA DEP*	72 **(24.8%)**	63 **(25.2%)**	72 **(22.3%)**	32 **(8.8%)**	239 **(19.5%)**
Industry official*	61 **(21.0%)**	68 **(27.2%)**	60 **(18.6%)**	48 **(13.2%)**	237 **(19.3%)**
University prof., researcher	43 **(14.8%)**	34 **(13.6%)**	58 **(18.0%)**	50 **(13.7%)**	185 **(15.1%)**
Local politician*	59 **(20.3%)**	42 **(16.8%)**	21 **(6.5%)**	57 **(15.7%)**	179 **(14.6%)**
Environmental organization*	60 **(20.7%)**	52 **(20.8%)**	49 **(15.2%)**	12 **(3.3%)**	173 **(14.1%)**
Local agency or official*	38 **(13.1%)**	27 **(10.8%)**	16 **(5.0%)**	60 **(16.5%)**	141 **(11.5%)**
Unaffiliated (general public, residents)†	37 **(12.8%)**	40 **(16.0%)**	29 **(9.0%)**	27 **(7.4%)**	133 **(10.8%)**
State agency or official	27 **(9.3%)**	30 **(12.0%)**	38 **(11.8%)**	33 **(9.1%)**	128 **(10.4%)**
Industry group*	42 **(14.5%)**	38 **(15.2%)**	31 **(9.6%)**	12 **(3.3%)**	123 **(10.0%)**
Non-profit org.† (other than above)	30 **(10.3%)**	31 **(12.4%)**	22 **(6.8%)**	17 **(4.7%)**	100 **(8.1%)**
Landowner group*	40 **(13.8%)**	45 **(18.0%)**	6 **(1.9%)**	3 **(0.8%)**	94 **(7.7%)**
Local business*	14 **(4.8%)**	15 **(6.0%)**	15 **(4.6%)**	46 **(12.6%)**	90 **(7.3%)**
Law-related (judge, police, lawyer)*	28 **(9.7%)**	31 **(12.4%)**	17 **(5.3%)**	6 **(1.6%)**	82 **(6.7%)**
Federal agency or official	21 **(7.2%)**	17 **(6.8%)**	17 **(5.3%)**	13 **(3.6%)**	68 **(5.5%)**

Anti-fracking group*	21 **(7.2%)**	21 **(8.4%)**	1 **(0.3%)**	5 **(1.4%)**	48 **(3.9%)**
Federal politician	10 **(3.4%)**	10 **(4.0%)**	8 **(2.5%)**	7 **(1.9%)**	35 **(2.9%)**
Arts-related (artists, performers, writers)	5 **(1.7%)**	9 **(3.6%)**	4 **(1.2%)**	3 **(0.8%)**	21 **(1.7%)**

* ANOVA comparing percentages across newspapers is significant at $p < 0.001$
† ANOVA significant at $p < 0.01$

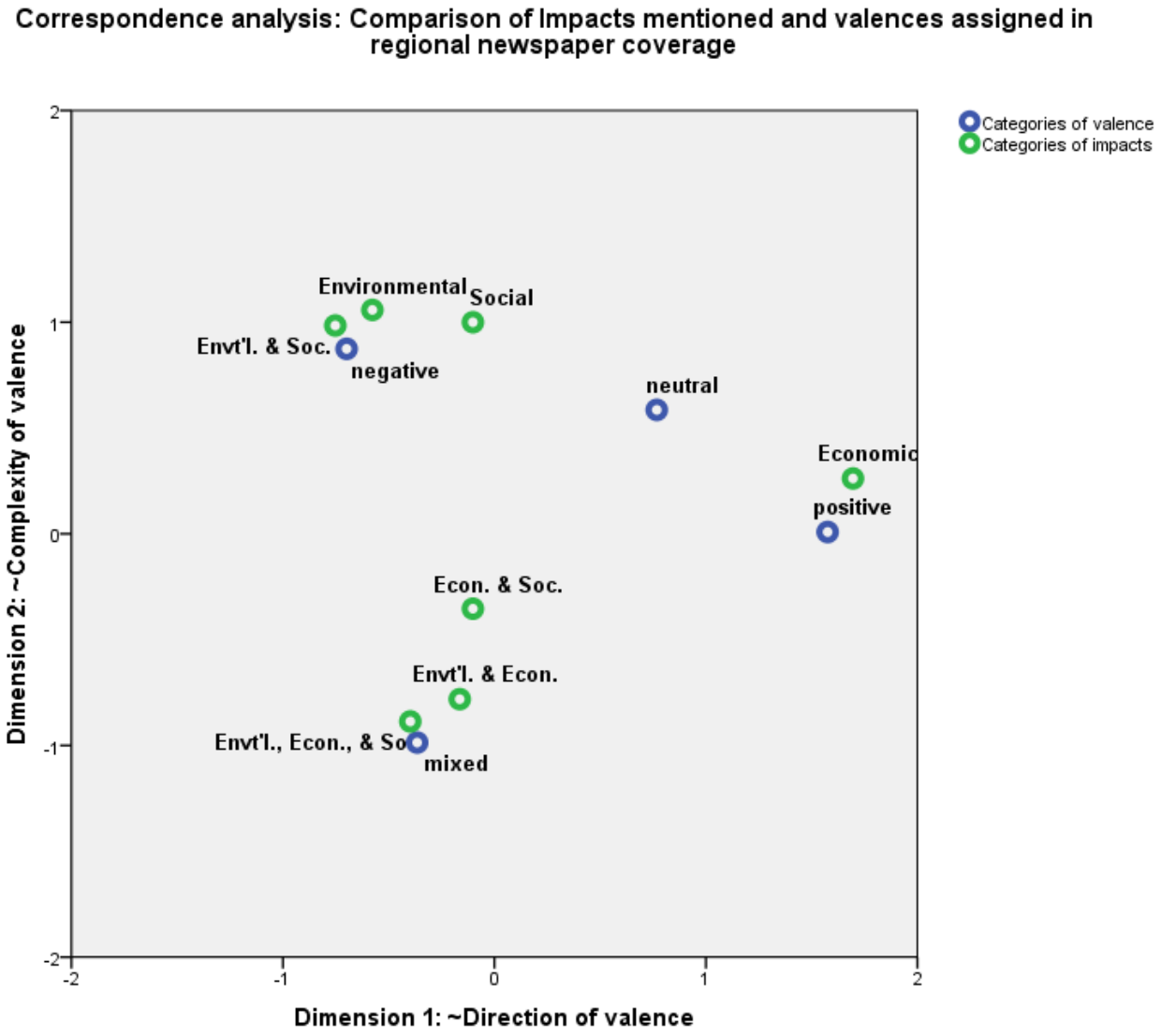
The sources cited in newspapers speak to relevance of various fora for emergence of social representations. Overall, the most commonly referenced sources were: state politicians, NY DEC and/or PA DEP (i.e., the state environment agencies predominantly in charge of shale gas development via hydraulic fracturing), industry officials, and university professors and/or researchers (all cited in 15-20% of the total articles in the analysis). One also notices substantial variation across newspapers in which sources were cited. For example, Williamsport had a significantly smaller percentage of articles that included comments, quotes, or data from: DEC/DEP, environmental organizations, industry groups, industry officials, and law-related individuals. This same newspaper (Williamsport), however, had a significantly higher percentage of articles that cited local business, compared to the other papers. Both Pennsylvania newspapers cited a substantially lower percentage of landowner groups, anti-fracking groups, non-profit organizations, and "unaffiliated" residents, compared to the New York newspapers. I offer hypotheses for these disparities later in this chapter and in Chapter Seven.

VI. Relationships Between Valences and Impacts

One way of examining the relationship between impacts and valence is through correspondence analyses. These statistical tests are similar to factor analyses, but allow for the comparison of two sets of categorical (i.e., multiple nominal) variables, as opposed to continuous data. Correspondence analyses generate correspondence tables of cross-tabulations that highlight the overlap between each variable; they also produce plots that represent the data structure graphically. In the plot, "the distances between category points…reflect the

relationships between the categories, with similar categories plotted close to each other" (IBM SPSS, 2011). I conducted three correspondence analyses to characterize SR of impacts and valence.

Figure 4.3: Correspondence analysis comparing impacts and valences



The correspondence analysis (Figure 4.3) shows, unsurprisingly, that articles containing only environmental or social impacts tend to be associated most closely with a negative overall valence for the article. Likewise, articles with only economic impacts mentioned tend to be

closely associated with a positive overall article valence. Interesting results come from the combined categories of impacts. Articles that included social and environmental impacts, but not economic impacts, also closely associated with negative valences. Nevertheless, any category that included economic impacts with social and/or environmental impacts was associated most closely with mixed valence.

I have provided titles for the axes in Figure 4.3 based on the structure of the dimensions that emerged from the correspondence analysis. In the same way that a factor analysis does not truly label dimensions, but allows a researcher to see which variables tend to pool together, the correspondence analysis produces dimensions that the researcher must interpret. The major differentiation across the x-axis, "~Direction of valence", is the extent to which the article contains positive or negative impacts. The major differentiation across the y-axis, "~Complexity of valence", is the extent to which the article has a single valence or multiple valences for impacts cited within it.

An important statistic for interpreting correspondence analyses is the "inertia". Inertia refers to the variance that can be explained by the data, similar to an R^2 value in a linear regression (the mathematical definition is the total Pearson Chi-square for a two-way test, divided by the total sample size). The inertia for the analysis in Figure 4.3 was very high at 0.934 (0.484 due to dimension 1 and 0.434 due to dimension 2). The Chi-square statistic was 1036.2, with $p < 0.001$.

I also conducted correspondence analyses to examine differences between newspaper outlet, valence, and impacts cited. An analysis comparing newspaper and valence indicated that Scranton newspaper articles most closely associate with negative and neutral overall valences, that Binghamton and Elmira articles most closely associated with mixed overall valence, and that Williamsport articles associate most closely with positive valence articles. While the Chi-square test for this analysis indicated a strong relationship (108.3, with $p < 0.001$), the inertia for this comparison was rather low (0.097). Likewise, a correspondence analysis that compared newspaper and impacts cited was similar to the second correspondence analysis. It showed

pooling of impacts near newspapers that one would have anticipated, based on Tables 4.1-4.3, but it also had low inertia (0.109). Again, the Chi-square statistic (121.2) had a p-value less than 0.001.

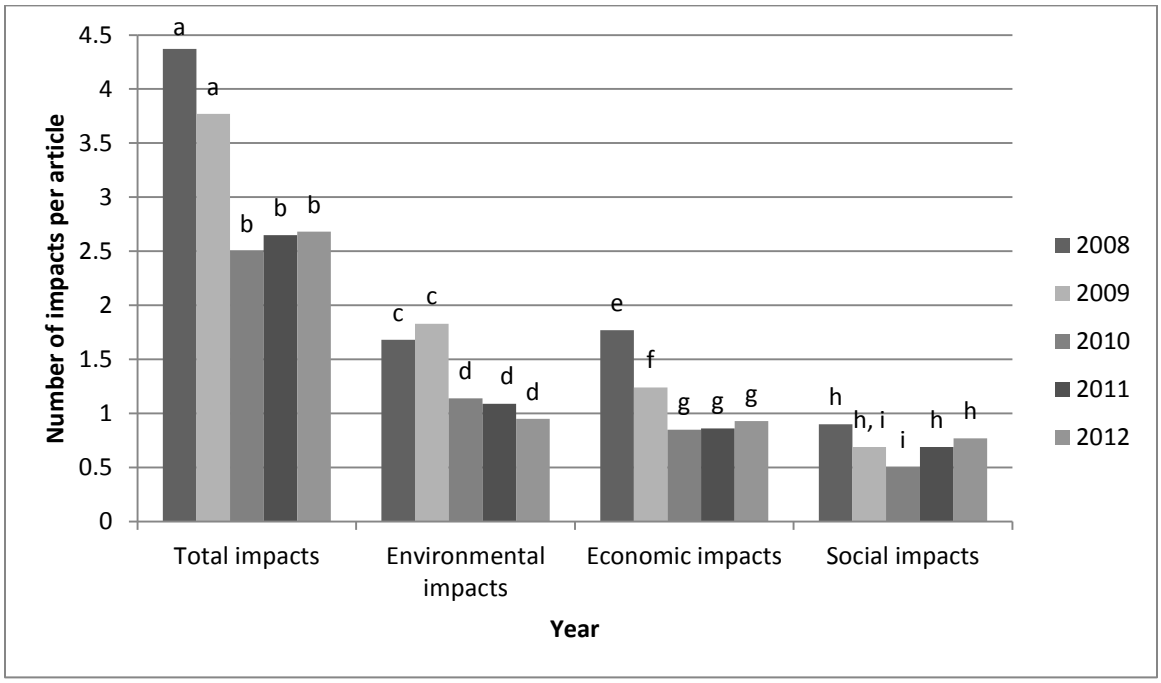
VII. Longitudinal (2008-2012) Variations in Newspaper Coverage on "Marcellus Shale"

Social representations theory predicts that representations vary across communities due to history, culture, and social structure that also vary across the landscape. Contrasts in SR across geographic locations were evident in the preceding sections. SR theory, unlike Durkheim's collective representations, also posits that representations can change, or evolve, in a substantial way over the period of a few years. To examine whether representations were becoming more or less prominent over time, I analyzed several generalized linear models that examined: (1) the extent to which the average number of impacts mentioned per article changed over time and (2) the extent to which the percentage of articles that mentioned at least one impact per article changed over time. For both analyses, I considered variation in total impacts and in each of the three categories of impacts: environmental, economic, and social.

A. Number of impacts mentioned per article

A generalized linear model with log link function and Poisson distribution, with number of impacts per newspaper article as the dependent variable and year as the independent variable, reveals no significant change in the average number of impacts cited across the newspapers from 2008 to 2009. However, a significant decrease exists from each 2008 and 2009 to 2010 (accounting for multiple comparisons with Bonferroni corrections) (Figure 4.4). From 2010 to 2011 to 2012, the average number of impacts cited per article did not change significantly.

Figure 4.4: Poisson regression estimated means for number of impacts mentioned per newspaper article, by year



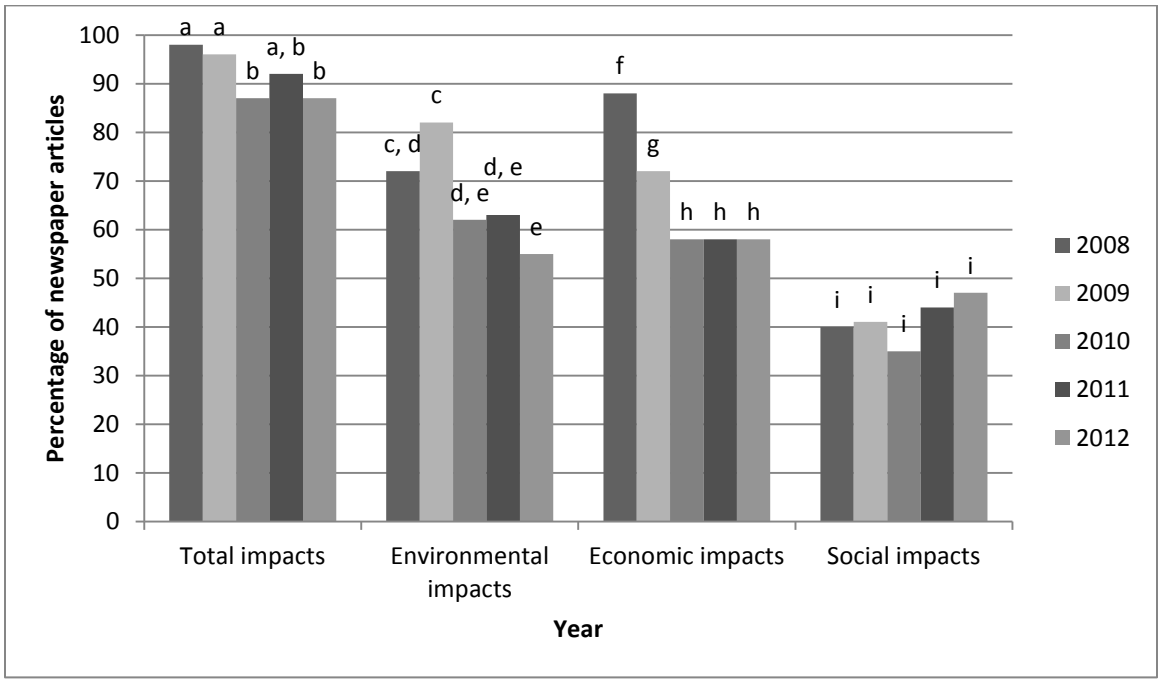
All columns with the same letter do *not* differ significantly at $p < 0.05$; "a" differs from "b" at $p < 0.001$; "c" differs from "d" at $p < 0.01$; "e", "f", and "g" differ from each other at $p < 0.05$; "h" and "i" differ from each other at $p < 0.05$. "Number of impacts per article" is the model's predicted mean count for each type of impact in each year.

Models using number of environmental impacts and number of economic impacts as the dependent variables revealed the same trend. For environmental impacts, the average number of impacts mentioned in 2008 and 2009 did not differ significantly, but the average number of impacts mentioned was significantly higher for both 2008 and 2009, compared with 2010-2012. For economic impacts, the average number of impacts cited across the newspapers decreased significantly from 2008 to 2009 and then from 2009 to 2010. From 2010-2012, the average number of impacts mentioned per article did not vary significantly. For social impacts, no trend was apparent. The average number of impacts mentioned per article was lower in 2010 compared to all the other years, save 2009, but there was no significant difference in average number of impacts mentioned across any of the other years.

B. Percentage of articles that mention any impacts

In addition to a longitudinal decrease in the number of impacts mentioned per newspaper article, the results of the generalized linear models also reveal a decrease over time in the average percentage of articles that cite at least one impact (Figure 4.5). I analyzed generalized linear models with a logit link function and binomial distribution, with the dependent variable as whether an article mentioned an impact or not, and the independent variable as year. The average percentage of articles citing at least one impact of any type was significantly higher in 2008, compared with 2010 and 2012; this same relationship held for 2009 compared to 2010 and 2012.

Figure 4.5: Binary logistic regression estimated means for the percentage of newspaper articles mentioning at least one impact, by year



All columns with the same letter do *not* differ significantly at $p < 0.05$; "a" differs from "b" at $p < 0.05$; "c", "d", and "e" differ from each other at $p < 0.05$; "f", "g", and "h" differ from each other at $p < 0.05$. "Percentage of newspaper articles" is the model's predicted mean probability that each type of impact would be mentioned in an article in a given year.

Models using presence/absence of at least one environmental impact per article and at least one economic impact per article as the dependent variables revealed the similar trends. For environmental impacts, the average percentage of articles citing at least one impact did not differ significantly between 2008 and 2009, but the average percentage was significantly higher in both 2008 and 2009, compared with 2012. Additionally, the average percentage of articles citing at least one environmental impact was significantly higher in 2009, compared with 2010 and 2011. For economic impacts, the average percentage of articles citing at least one impact decreased significantly from 2008 to 2009 and then from 2009 to 2010. From 2010-2012, the average percentage of articles citing at least one impact did not vary significantly. The average percentage of newspaper articles mentioning a social impact did not vary significantly across any years, after applying Bonferroni corrections for multiple comparisons.

The stark differences between the trends in environmental and economic impacts, compared to social impacts, led me to examine frequency data on presence/absence of social impacts in the newspaper coverage across the five years in my sample (Table 4.9). While some of the trends in individual social impacts mirror the general trend seen in the environmental and economic categories of impacts (e.g., roads and/or infrastructure, noise, dust, aesthetic beauty, community character, energy independence), other impacts trend in the exact opposite direction (e.g., public safety, public health, community services). Because the few impacts that trended in the reverse direction were mentioned overall more frequently than many of the other social impacts, it seems they influenced the average count for social impacts and the average probability of at least one social impact being cited.

Table 4.9: Frequency of social impacts mentioned in regional newspaper coverage, by year

	2008	**2009**	**2010**	**2011**	**2012**	**TOTAL**
Public health† (also family, personal)	2 **(2.3%)**	31 **(15.1%)**	38 **(9.5%)**	50 **(14.6%)**	31 **(16.3%)**	152 **(12.4%)**
Roads and/or Infrastructure	17 **(19.5%)**	22 **(10.7%)**	45 **(11.2%)**	42 **(12.2%)**	21 **(11.1%)**	147 **(12.0%)**
Roads	14 **(16.1%)**	20 **(9.8%)**	32 **(8.0%)**	34 **(9.9%)**	16 **(8.4%)**	116 **(9.5%)**
Infrastructure (e.g., bridges, buildings)	7 **(8.0%)**	4 **(2.0%)**	17 **(4.2%)**	13 **(3.8%)**	12 **(6.3%)**	53 **(4.3%)**
Traffic	7 **(8.0%)**	17 **(8.3%)**	24 **(6.0%)**	26 **(7.6%)**	10 **(5.3%)**	84 **(6.8%)**
Community services‡ (police, fire)	3 **(3.4%)**	6 **(2.9%)**	12 **(3.0%)**	23 **(6.7%)**	14 **(7.4%)**	58 **(4.7%)**
Energy independence‡ (from other nations)	7 **(8.0%)**	5 **(2.4%)**	14 **(3.5%)**	25 **(7.3%)**	5 **(2.6%)**	56 **(4.6%)**
Noise*	13 **(14.9%)**	17 **(8.3%)**	11 **(2.7%)**	6 **(1.7%)**	5 **(2.6%)**	52 **(4.2%)**
Public safety* (crime, pedestrian safety)	1 **(1.1%)**	7 **(3.4%)**	15 **(3.7%)**	10 **(2.9%)**	19 **(10.0%)**	52 **(4.2%)**
Community character†	9 **(10.3%)**	12 **(5.9%)**	13 **(3.2%)**	13 **(3.8%)**	2 **(1.1%)**	49 **(4.0%)**
Non-specific social impacts	4 **(4.6%)**	5 **(2.4%)**	4 **(1.0%)**	11 **(3.2%)**	5 **(2.6%)**	29 **(2.4%)**
Housing availability	2 **(2.3%)**	2 **(1.0%)**	6 **(1.5%)**	9 **(2.6%)**	8 **(4.2%)**	27 **(2.2%)**
Aesthetic beauty‡	4 **(4.6%)**	5 **(2.4%)**	1 **(0.2%)**	5 **(1.5%)**	2 **(1.1%)**	17 **(1.4%)**
Outdoor recreation (quality, opportunities)	1 **(1.1%)**	3 **(1.5%)**	3 **(0.7%)**	2 **(0.6%)**	4 **(2.1%)**	13 **(1.1%)**
Dust* (from trucks, industry)	7 **(8.0%)**	3 **(1.5%)**	1 **(0.2%)**	1 **(0.3%)**	0 **(0.0%)**	12 **(1.0%)**
Light pollution	0 **(0.0%)**	1 **(0.5%)**	3 **(0.7%)**	2 **(0.6%)**	1 **(0.5%)**	7 **(0.6%)**
Distribution (of wealth, gains, loses)	0 **(0.0%)**	3 **(1.5%)**	1 **(0.2%)**	1 **(0.3%)**	0 **(0.0%)**	5 **(0.4%)**
Other social impacts* (anything not listed above)	0 **(0.0%)**	6 **(2.9%)**	7 **(1.7%)**	2 **(0.6%)**	11 **(5.8%)**	26 **(2.1%)**

* ANOVA comparing percentages across newspapers is significant at $p < 0.001$
† ANOVA significant at $p < 0.01$
‡ ANOVA significant at $p < 0.05$

VIII. Interviews with Journalists; Explanations for Patterns and Trends

I interviewed the journalist at each newspaper who wrote the largest share of that paper's coverage on "Marcellus Shale". The data below is grouped by patterns I hoped the journalists could explain.

A. Why did reporting focus on these specific impacts?

1. Limited resources

Dave Thompson, who wrote over 200 articles mentioning "Marcellus Shale" for the Williamsport Sun-Gazette, explained that his coverage was mostly a reflection of local discourse about the issue because his newspaper has very limited resources:

> Being a small paper, we only have ten full-time reporters. We juggle so many different beats. I probably have five or six, or more, beats today. So, a lot [of my reporting on Marcellus Shale] was reacting to meetings, public hearings, and things like that.

Dave Thompson followed up on this point by reiterating this major influence on his reporting over thirty minutes later in the interview:

> Again, we're a small paper; we end up covering a lot of meetings, and it seemed like for a while there the Marcellus Shale was all anybody talked about. I think my sources were not necessarily people who I sought out; they were the people who were presenting at certain times. [The coverage] was probably more reactionary on our part.

This idea of small, local papers reflecting and reacting to local discourse on shale gas development, and looking to local public meetings and community events for journalistic material, was not unique to Williamsport. Tom Wilber, who had over 200 of his articles published in the Binghamton Press and Sun Bulletin, and over 100 of his articles published in the Elmira Star-Gazette, expressed such a sentiment: "For this issue, [finding sources] wasn't so hard because everyone was coming to you." Wilber also stressed that,

> A lot of this [conversation on shale gas issues] was hashed out in these town hall meetings … This was a really interesting story journalistically, because it drew people out. You are reporting about your audience, but you are also including their voices in your reporting.

Jon Campbell, who was published on this issue nearly 200 times in the Binghamton paper and over 100 times in the Elmira paper, corroborated Thompson's and Wilber's assertions about the importance of obtaining information from public meetings/events:

> Early on, just by going to a couple rallies, a couple public meetings, you would keep on seeing the same faces over and over and over. You would start to realize that those are the ones who are organizing; those are the ones who are putting on the pressure, on the side of landowners and the industry as well as the environmentalists.

These "faces" ended up being many of Campbell's sources for his reporting.

2. Giving a voice to the voiceless

All four journalists expressed that the issue of shale gas development quickly became so enormous that it was impossible to remain apprised of all the developments. Because the four newspapers are local/regional papers, most articles tended to not only capture the voices of the people who were speaking up most loudly and frequently, particularly at public meetings and events, but also to represent key issues of local importance. Additionally, while mostly reflecting public discourse, some journalists were explicit about their goal of allowing voices to be heard on this issue of people who may not have many other outlets to share their message. Laura Legere, who wrote over 200 articles for the Scranton newspaper focused on "Marcellus Shale" issues, commented:

> I think, just like we have a role in terms of being a watchdog, or as being skeptics of some of the most optimistic promises about this industry, to some extent, we also have a role in giving voice to people who don't have the same ability to be heard as the gas industries' legions of PR people or their massive ad campaigns. This is not to equate our news to promotional ads on TV, but we do play an important role in getting out a message that has not been very well funded.

Legere followed up by being more explicit on the need to compensate for power differentials between oil and gas companies/industry and local residents:

> Particularly in a small, local paper like ours, we have an interest in allowing [unprivileged] voices to be heard. The ability to share one's message is not the same; it is to some extent David and Goliath. It is not the same as two neighbors having a conversation.

Tom Wilber (NY newspapers) agreed:

> One of the media's jobs is to be an agent for change – this is a "liberal media", [Joseph] Pulitzer idea – but you can't be an agent for change unless you are giving a voice to the common person … "Liberal media" is a media for social change; it's the media that give voice to the community member; it's free speech; it's that everybody has a voice and everybody has an equal voice. It's the idea of balancing wealth, affluence, and influence with the people who don't have affluence or influence.

The only newspaper in which a leading journalist did not express a desire to represent unheard voices (and also the newspaper under the greatest constraints due to limited resources) – Williamsport – was also the newspaper with the highest percentage of positive impacts across the environmental, economic, and social categories.

3. The status of development locally, and historically

Beyond the constraints of the newspaper itself (e.g., limited resources) and the personal commitments of the journalists (e.g., extent of interest in helping small voices be heard), the broader physical and political landscape affected impacts reported and valence assigned to those impacts. In NY, no development had occurred between 2008-2012, but many groups formed with the goal of ensuring that development could occur as quickly as possible, or that it would never occur. Jon Campbell (NY newspapers) asserted:

> I think there is a pretty easy explanation for why our papers [Binghamton and Elmira] had a more diverse array of sources than the Pennsylvania papers. I think it is largely because the environmental groups put enormous pressure on the regulators – the DEC and the state. Therefore, both of those sub-sets [the environmental groups and the regulators] are featured more in the stories here because they're such a large part of the story right now; whereas, in Pennsylvania, they just started drilling, so the drillers and the local businesses, and all of that, played a bigger part in the story to date.

Jon Campbell reveals that social organization and mobilization on the issue affected coverage not only due to sources coming to the newspaper/journalist directly, but also due to exerting influence on the social discourse in the communities included in his coverage.

In areas where "they just started drilling", the coverage reflected local reactions to the effects of development. For example, Dave Thompson (Williamsport) explained:

> I think people realize a boom/bust cycle is part of this deal. There is a general feeling that our community leaders want to make this place sustainable, by taking the prosperity that the area is seeing and using that to make this a more interesting place to live in … People see the positives outweighing the negatives of what has happened in just about every other boomtown.

Therefore, Dave Thompson asserts that local residents know the economy is doing well currently due to the natural gas development and that this economic boom will not last, but they believe that on the whole development will be better for the community in the long run. He explained that local politicians and policy makers were using the largess from the natural gas boom to develop a river walk in the town, which was populated with sculptures and art work; it was used to fund museums and the local hockey team. In the minds of local residents, the efforts toward a cultural renaissance and reimagining of the city as a center for the arts were connected to shale gas development.

In Scranton, the local development (and legacy of fossil fuel extraction previously) had a different effect on coverage. Laura Legere spoke to the difference between Scranton and Williamsport in terms of focus on economic impacts, such as jobs and effects on local business:

> Williamsport has seen a very direct boom economy from this industry, while [in] the area we cover…it is not nearly of the magnitude seen in other places. It has not become what some people had hoped it would be … Some of those natural stories about everyone cashing in, although we do write them, are not staring you in the face quite in the way they are in other places. And because the wells being drilled are on the periphery of our main county, Lackawanna County, we are not seeing the direct "impact fee" impact.

Scranton, and the county in which it resides, had not become a hub of industry activity in the way that Williamsport (and Lycoming County) had, even though wells were close by.

The recent history with shale gas development and its local effects were not the only thoughts in the minds of residents near Scranton. Laura Legere explained the connection to more distant history of perspectives on shale gas development:

> We live in a town and a region that is still very visibly environmentally scarred from a history of coal mining. It comes up here a lot that people are concerned about another environmental legacy like that one. Even though the parallels are probably not that strong, I think there is a feeling among the people in this valley of weariness to large extraction industries. There is a very strong feeling of suspicion and there is a

> willingness to wait for some kind of assurance that there won't be long term environmental implications that they saw in the past. It is so visible. The coal dumps are still there and the acid mine drainage still turns the river orange.

As the coal industry began to diminish in the Scranton area following World War II, the folding companies left behind a landscape scarred with abandoned mines (including strip mines), rivers tainted with acid mine drainage, and occasionally homes claimed by mine subsidence.

4. Regulation of shale gas development

Jon Campbell's previous quote about involvement of environmental groups in decision making and the differential importance in NY of the regulatory process, compared to PA, shows that status of regulation on this topic could affect coverage by making political issues more or less salient. While PA was dealing mainly with issues caused by development (e.g., positive economic impacts in Williamsport and concerns about negative environmental impacts occurring locally in Scranton), NY was dealing primarily with a decision about whether and how to permit shale gas development.

In the NY newspapers, both Gannett journalists agreed that the state of regulation (i.e., no high-volume hydraulic fracturing permitted and an on-going public debate about the pros and cons) fostered a more uniform state-wide discourse on the issue and less geographical context specificity across newspapers. Jon Campbell illustrated how this conversation was unique from PA:

> In New York, it is framed as a decision – yes or no to whether we will move forward – which has galvanized both sides of the base. Whereas, in Pennsylvania, it just happened. There wasn't time. I don't think many people realized what was happening. New York took a pause, and ever since, both sides have been fired up about it.

Jon Campbell painted the public discourse he hears in NY as an overly simplistic debate between negative environmental impacts and positive economic impacts, which speaks to the relatively frequent attention to these types of impacts (particularly to "non-specific" impacts) in the NY newspapers.

B. Why did reporting vary across years?

Three of the four journalists I interviewed had been writing on shale gas development in the Marcellus Shale from the beginning (late 2007 / early 2008) – Tom Wilber, Dave Thompson, and Laura Legere. Jon Campbell started coverage in 2010, as Tom Wilber began to write less on this topic. Tom Wilber pointed out that in the early years of coverage, there were few enough events (e.g., meetings, public hearings, protest rallies) that he could attend every event in the Binghamton area. He also had time to write retrospective reflection articles for the Sunday editions of the newspaper. These reflection articles tended to be much longer (between 1000-2000 words) compared to articles based on specific events. For example, in 2008, 15% of all of the Binghamton newspaper's coverage mentioning "Marcellus Shale" (i.e., all coverage, not just the sample I coded) was over 1000 words long. In 2009, this percentage dropped to 12%, and then to 7% in 2010 and 2011.

One explanation for the decreasing number of impacts mentioned in newspapers over time, and for the decreasing likelihood that any article would mention an environmental or economic impact over time, is that the increasing number of events and amount of information on this topic prevented journalists from writing the more detailed retrospective and reflective pieces. Dave Thompson (Williamsport) also agreed that writing thorough pieces became more difficult as time wore on. He even explained that his newspaper needed to turn increasingly to the Associated Press for coverage of shale gas issues in late 2011 and into 2012 due to the amount of information available and his newspaper's limited reporting resources. Of the increase in discourse related to shale gas development over time, Thompson reflected, "it was an avalanche".

Laura Legere (Scranton) explained that she makes an effort to include in her coverage the type of reflective, synthesis articles that Tom Wilber wrote in his early coverage:

> Some of [my reporting] is just explanatory – this is happening, this report just came out, this event took place. Perhaps there is a new statistical analysis as to how much gas is being produced, or news from a community meeting. But then also, because it is a new issue, or simply because it is part of our mission, we want to raise some of the unknowns

> and try to explore them with people who may have the best answers or who ask the best questions about what we are looking at. To some extent that falls into investigative journalism.

Legere's investigative journalism became less possible over time, due to the increased volume of information of which the journalists needed to remain apprised.

While none of the journalists expressed it during their interviews, it is also possible that they assumed certain information had already been made public and was no longer novel enough to warrant mention. For example, Laura Legere points to the need for investigative reporting due, in part, to shale gas development being a new issue. When it is no longer a new issue, is this level of more comprehensive, exhaustive attention to the issue and the deeper reflection less necessary? Tom Wilber elucidated for me, "Through natural selection, journalists are always looking for a unique angle. They are looking for something that hasn't been covered yet." One hypothesis for the decrease in the number of impacts over time, and likelihood that any impact is mentioned, is that new impacts were not emerging in later years and that journalists assumed the previously cited impacts were relatively common knowledge by that point.

Another hypothesis is that the nature of the discourse itself changed and became more restricted over time. Jon Campbell's previously quoted characterization of shale gas development as a "yes or no" issue shows that public discourse was less focused on specific impacts than it was on whether shale gas development would occur or be banned, and how either goal could be accomplished politically. Campbell started covering this issue in 2010; in the early years of coverage, people were still trying to learn more about the issue. By the time Campbell began his coverage, many had their minds made up. Campbell explained:

> There is one extreme saying that this is going to save the Southern Tier economy; this is exactly the prescription we need to save the struggling Southern Tier. Then you have another extreme that says this is going to poison our water, this is going to destroy our roads; this is going to wreak havoc.

The extreme voices on this issue hijacked the public discourse. Therefore, to the extent that local newspaper coverage simply reported on meetings and events related to shale gas development in the later years, that coverage would not capture much nuance.

C. Relating coverage to the journalists' insights

Across all impacts broadly, there was less focus on economic impacts in Scranton and less focus on environmental impacts in Williamsport, relative to the other papers. Additionally, Williamsport had a higher percentage of positive environmental impacts and lower percentage of negative environmental impacts, whereas Scranton had a higher percentage of negative economic impacts and lower percentage of positive economic impacts. The two newspapers in Pennsylvania formed the extremes on amount of coverage of environmental and economic impacts as well as valence of those impacts.

The NY newspapers covered some events in PA, but they mostly focused on discussion of what *could* happen in relation to shale gas development in NY. Extreme positive voices still screamed about benefits and extreme negative voices still screamed of risks, fostering a mix of impacts and valences in the coverage. In Scranton, the locals had already seen disappointing economic outcomes and unrealized potential from shale gas development. Additionally, their history with environmental destruction from coal was not shared by any of the other cities in which newspapers were located. Thus, more focus on environmental and negative impacts, less focus on economic and positive impacts. The Scranton paper also had more resources than the Williamsport paper to engage in investigative journalism, which allowed for journalists to speak with residents who claimed to have been exposed to environmental ills from shale gas development. In Williamsport, locals spoke regularly of economic benefits; the people who held public events on shale gas development (which were heavily reported on in local coverage) mainly extolled the virtues of development.

The NY newspapers (as a group) also differed from the PA newspapers (as a group) on several variables. Non-specific impacts (both environmental and economic), leases and/or royalties, noise, public health, and negative valence for social impacts were significantly more common in the NY papers. Almost all of these differences can be explained by the focus on the political debate in NY versus the focus on effects (triumphs and woes) of actual development in

PA. The political debate in NY grew to be framed around economic versus environmental impacts. Because this was mostly a debate about what could happen and not an enumeration of things that necessarily did happen, it is not surprising that there was less specificity (i.e., more references to non-specific impacts).

Most references to noise in NY occurred in the early years, before the political debate lost all nuance. The public health focus emerged in the later years in NY as part of the political discourse. The NY State Department of Health undertook a study to examine potential effects of shale gas development on human health, raising the profile of this impact in newspaper coverage. Public health is mostly discussed in negative light; therefore the heightened focus on public health in NY might explain the increased assignment of a negative valence to social impacts in the Binghamton and Elmira newspapers.

Leases and royalties appeared in NY coverage substantially more than in PA coverage. While the explanation for this relationship is less clear than those above, it is likely that the nature of development led to this difference. There was no development in NY; therefore, the only major realized economic effect from shale gas thus far in the state was leases, which had already produced substantial income for some residents. Residents who had leased, or who were planning to lease, wanted to also benefit from royalty payments. In PA, leases and royalty payments seemed to be taken as a given; they were simply a background characteristic to all the other effects of shale gas development.

IX. The Effect of Sources Cited on Impacts and Valence

One factor that emerged in the journalist interviews as important for representations in newspaper coverage was the sources the journalists included in their reporting. I ran several binary logistic regression models to test for the effect of various sources cited in articles on impacts and valences. I only report the final models here (i.e., after removing weakly predictive and non-significant variables). For each regression below, I report the odds ratio [Exp(B)], two pseudo-R-square values (Cox & Snell R^2 and Nagelkerke R^2), the Chi-square value and

significance for the Hosmer and Lemeshow Test, and the improvement in the percentage of cases predicted correctly due to the independent variables in the regression. The odds ratio is the factor by which the odds of the dependent variable being present will change if a given source is present (as opposed to be absent). The dependent variable in each of my models is whether a particular article includes or does not include a category of impact or valence.

The pseudo-R-square values both function similar to R^2 values in a linear regression, expect they measure the variance accounted for differently due to dealing with data distributed across a logistic function. The Cox & Snell R^2 is a more conservative measure that is not presented on a standardized scale, with a variable maximum which is less than 1.0. The Nagelkerke R^2 is presented on a standardized scale from 0.0 to 1.0 and, therefore, can be interpreted more closely to an R^2 in a linear regression. The Hosmer and Lemeshow Test computes a goodness-of-fit statistic that reveals whether the researcher can reject the null hypothesis that no difference exists between the observed values and the values predicted by the model for whether cases are predicted correctly. A significance of greater than 0.05 indicates well-fitting models.

A. The effect of sources cited on impacts mentioned

The first logistic regression reveals that sources cited explain about 15-20% of the variation in whether an environmental impact was mentioned or not in the newspaper coverage (Table 4.10). Articles that cited a federal agency or official (in practice, this was mostly the US Environmental Protection Agency), the NY DEC and/or PA DEP, or an environmental organization were most likely to mention an environment impact, all else equal (i.e., these sources had the highest odds ratios above 1.0). Articles that cited state agencies or officials (other than those involved in the DEC/DEP), local business, or law-related individuals were least likely to mention an environmental impact, all else equal (i.e., these sources had the lowest odds ratios below 1.0).

Table 4.10: Sources cited in coverage as predictors for environmental impacts mentioned

Source	Wald	Sig.	Exp(B)
State agency or official	**10.2**	**0.001**	**0.515**
Federal agency or official	**13.1**	**0.000**	**4.521**
NY DEC / PA DEP	**51.7**	**0.000**	**4.790**
Environmental organization	**25.6**	**0.000**	**3.604**
Local business	**10.4**	**0.001**	**0.466**
Unaffiliated	**16.5**	**0.000**	**2.753**
Arts-related	**4.0**	**0.046**	**3.568**
Law-related	**7.6**	**0.006**	**0.495**
Constant	**8.1**	**0.004**	**1.258**

Cox & Snell R^2 = 0.152, Nagelkerke R^2 = 0.208; Hosmer and Lemeshow Test Chi-square = 8.002, sig. = 0.156; percent correctly classified before entering independent variables = 64.1%, percent correctly classified after entering independent variables = 68.5%

The second logistic regression indicates that sources cited explain about 9-12% of the variation in whether an economic impact was mentioned or not in the newspaper coverage (Table 4.11). Articles that cited local businesses were most likely to mention an economic impact, all else equal. Articles that cited federal agencies or officials were least likely to mention an economic impact, all else equal.

Table 4.11: Sources cited in coverage as predictors for economic impacts mentioned

Source	Wald	Sig.	Exp(B)
Local politician	**11.2**	**0.001**	**1.875**
Federal agency or official	**15.5**	**0.000**	**0.340**
NY DEC / PA DEP	**4.6**	**0.032**	**0.710**
Industry group	**5.4**	**0.020**	**1.663**
Industry official	**4.1**	**0.042**	**1.402**
Landowner group	**15.1**	**0.000**	**2.969**
Local business	**23.8**	**0.000**	**5.382**
University professor / researcher	**4.0**	**0.044**	**1.432**
Non-profit organization	**14.1**	**0.000**	**2.809**
Constant	**2.1**	**0.147**	**1.134**

Cox & Snell R^2 = 0.091, Nagelkerke R^2 = 0.123; Hosmer and Lemeshow Test Chi-square = 5.886, sig. = 0.436; percent correctly classified before entering independent variables = 61.6%, percent correctly classified after entering independent variables = 62.7%

The third logistic regression indicates that sources cited explain about 6-8% of the variation in whether a social impact was mentioned or not in the newspaper coverage (Table 4.12). Articles that cited anti-fracking groups, unaffiliated residents, or environmental organizations were most likely to mention a social impact, all else equal. Articles that cited landowner groups or industry officials were least likely to mention a social impact, all else equal.

Table 4.12: Sources cited in coverage as predictors for social impacts mentioned

Source	Wald	Sig.	Exp(B)
Local agency or official	**12.8**	**0.000**	**1.962**
Local politician	**9.3**	**0.002**	**1.687**
Industry official	**7.1**	**0.008**	**0.656**
Environmental organization	**15.9**	**0.000**	**2.000**
Landowner group	**5.5**	**0.019**	**0.565**
University professor / researcher	**4.6**	**0.031**	**1.430**
Unaffiliated	**15.8**	**0.000**	**2.182**
Anti-fracking group	**6.6**	**0.010**	**2.245**
Constant	**64.2**	**0.000**	**0.507**

Cox & Snell R^2 = 0.060, Nagelkerke R^2 = 0.081; Hosmer and Lemeshow Test Chi-square = 6.493, sig. = 0.370; percent correctly classified before entering independent variables = 59.1%, percent correctly classified after entering independent variables = 62.4%

B. The effect of sources cited on valences assigned

I used additional binary logistic regressions to investigate the potential influence of sources cited on the overall valence of the articles in my sample. My fourth logistic regression indicates that sources cited explain about 10-17% of the variation in whether an article contained an overall positive valence (Table 4.13). Articles that cited local businesses were most likely to have an overall positive valence, all else equal. Articles that cited environmental organizations,

the DEC/DEP, unaffiliated residents, and law-related individuals were least likely to have an overall positive valence, all else equal.

Table 4.13: Sources cited in coverage as predictors for an overall positive valence[1]

Source	Wald	Sig.	Exp(B)
State politician	**6.5**	**0.011**	**0.509**
NY DEC / PA DEP	**13.6**	**0.000**	**0.319**
Industry official	**4.9**	**0.026**	**1.608**
Environmental organization	**9.0**	**0.003**	**0.273**
Local business	**44.6**	**0.000**	**4.949**
Unaffiliated	**7.2**	**0.007**	**0.356**
Law-related	**6.7**	**0.010**	**0.250**
Constant	**186.2**	**0.000**	**0.217**

[1] Cox & Snell R^2 = 0.096, Nagelkerke R^2 = 0.168; Hosmer and Lemeshow Test Chi-square = 5.444, sig. = 0.488; percent correctly classified before entering independent variables = 85.1%, percent correctly classified after entering independent variables = 86.0%

I was unable to construct a binary logistic regression with adequate fit that included sources cited as significant predictors of overall negative valence. The pseudo-R^2 values for the models predicting overall neutral valence were very small (3-6%) and the percent correctly classified did not change at all. Therefore, I do not report on those regressions here.

C. The aggregate effect of sources cited

While the R^2 values were modest across the four binary logistic regressions, the Hosmer and Lemeshow Tests for each model show well-fitting models and the odds ratios reveal powerful explanatory variables. Overall, these results lend support to contention that SR (of impacts and valence) varied across newspapers in part due to journalists being exposed to different sources and including different sources in their coverage.

X. Moving Forward

The research in this chapter allowed me to characterize the frequency with which social representations about shale gas development were presented in a major public forum. In the next chapter, I present data from my interviews with individuals living in communities on which the four newspapers reported. I sought to better understand the extent to which the representations from the newspapers were also reflected in other forms of local discourse. I also sought to discover what nuance, if any, is lost by examining social representations only at the macro (societal) level.

Chapter Five: Interviews and Study Site Visits

"There are villains and heroes. … Rouges and straight shooters."
-- Tom Wilber, *Binghamton Press and Sun-Bulletin*, 28 December 2008
[Summary article on the newspaper's #1 story of the year: "the natural gas rush"]

I. Introduction

I conducted 47 interviews, one focus group conversation, and spoke informally with numerous store clerks, servers at restaurants, municipal officials, and local residents across nine communities – three each in New York (NY), Pennsylvania (PA), and New Brunswick (NB). Each interviewee characterized for me his/her own views on shale gas development via hydraulic fracturing and helped describe the discourse on this issue in his/her community. Their stories follow, in the form of major representations that emerged across my study sites.

As I enumerate and describe the social representations of shale gas development that emerged, the reader will recognize quickly differences across study sites and across jurisdictions (NY, PA, and NB). Some SR were employed frequently in interviews across all study communities, others were much more specific to particular social, cultural, historical, geographic, and/or regulatory contexts.

II. Study Sites

Two of my study sites in PA lay in the heart of shale gas development; one lies outside the area of prime development. One site in NY lies in an area with high development potential, one lies on the edge of the area with greatest development potential, and the third site is located in an area with moderate to minimal development prospects. All three communities in NB were located in areas where the province had leased substantial tracts of land for gas exploration and development. In one NB community, about 30 wells had been drilled and hydraulically fractured; in the other two, development had only been discussed.

Irrespective of the level of development or potential for development in each of these communities, shale gas development via hydraulic fracturing was a major (and in most cases, *the* major) topic of discussion locally in each community for at least two years leading up to my interviews in April and May, 2013. In several communities, the effects of shale gas development were highly visible, either through gas wells, truck traffic, housing expansion, and/or other indications of industry presence, or through obvious evidence of a debate raging in the community over whether or not shale gas development should exist there (e.g., signs on front lawns and telephone poles, newspaper articles daily, announcements for meetings posted in public places).

To better understand my study sites, and to determine which to include in the final nine that I selected for my interviews, I visited each of the communities in NY and PA in advance. In NB, I was unable to visit any communities in advance, but I stayed in each of my final study communities for about five days while conducting interviews. This helped me develop a cursory understanding of some contextual factors shaping discussion of shale gas development in those communities. In this section, I briefly characterize what I observed and experienced in each community and begin to paint a picture of each study location.

A. Communities in NY

1. Sanford and Deposit

My NY study site located in the heart of the area with greatest potential for development is actually two adjacent municipalities: the Town of Sanford and the Village of Deposit. These municipalities border Pennsylvania. Sanford is a rural town, tucked away in the far eastern corner of Broome County, which is also home to the City of Binghamton. There is no town center to speak of, simply scattered residential development with agriculture featured prominently throughout the landscape. As I drove through the area, I noticed cows, fields that would be planted with grain crops in the spring, a Christmas tree farm, and "wood for sale" signs. I spotted six signs related to shale gas development – all in favor. A small café near the

highway overpass that crosses the town and a modest church were the only non-residential buildings I encountered. The roads were narrow and in poor condition; I spent most of my drive straddling the yellow line.

Deposit is a small, closely-packed residential village just across the border from Sanford, in Delaware County. The main street offers restaurants, a limited grocery store, a movie theater with one screen (which also hosts performing arts and local events – including meetings about shale gas), and a library with five small rooms. I noticed four signs on telephone poles in the town in favor of shale gas development (all from the Joint Landowners Coalition of NY). While sitting in the library, I read the local weekly newspaper, The Deposit Courier. The lead article's title was "Fracking main topic of 2012 in Village" (16 January 2013).

2. Spencer and Van Etten

My second study site was once again two adjacent municipalities across two counties – Spencer and Van Etten. Van Etten, Chemung County, has a small village center with a post office, restaurant, village offices, church, convenience mart, and bar. The local weekly newspaper I picked up in the mini-mart ("Broader View Weekly") mentioned shale gas issues prominently, as did the cashier at this establishment, who recounted a number of local meetings on the topic. Signs supporting and opposing development were visible throughout the town. Once one leaves the Van Etten village center, the town becomes rural quickly – farms and forest.

The town center of Spencer, Tioga County, lies only about five miles from the center of Van Etten; a large, modern high school is situated between the town centers (a joint school district draws students from both towns). Spencer's center is more developed than Van Etten's, still with a small town feel, but containing multiple shops and places of business. The town contains numerous pro- and anti-shale-gas signs. An announcement about leasing was featured prominently on a bulletin board in the post office. The readers' comments section of a free local weekly newspaper ("The Owego Pennysaver") was filled with comments about shale gas development.

3. Dryden

The third study site I selected in NY was the Town of Dryden. This town is more populated than the other two study sites, but still contains large tracts of open space, rural areas, and plenty of agriculture. The eastern portion of the town is much less developed than the western portion, which is partially a suburb of the City of Ithaca. This town received national mass media attention in 2012 due to a ban the town board passed on shale gas development via hydraulic fracturing. Much of the town (about 40%) was leased for gas exploration and development at the time the ban was passed. A gas company owning many leases there challenged the ban in court. After several appeals, the right of the town to use zoning laws to govern shale gas development was upheld in the state supreme and appellate courts. Numerous meetings on shale gas issues have been held in Dryden. I have attended many of these meetings to observe local discourse.

B. Communities in PA

1. Cummings and the Pine Creek Valley

The Township of Cummings, PA, is located in heart of state forest land. While I have named Cummings as my study site, I conducted interviews more generally in the Pine Creek Valley area of PA, which includes Cummings and other townships to the north and south. This whole area can be described generally as one state highway with a few small side roads and houses scattered about. The population density in Cummings and McHenry Townships, combined, is three persons per square mile. Seventy to eighty percent of the land is state forest. Cummings has the highest concentration of drilling in any township in PA, but the development is not very visible due to it being mostly on mountain tops in the state forest. The local residents experience heavy truck traffic and see workers in places of business in the valley, but they witness few other signs of development.

A conversation I had with two employees at a combination diner, clothing store, gun shop, gas station in a Pine Creek Valley village revealed nuanced views of shale gas development. They were prepared to accept the good (increased business) and deal with the bad (dust, traffic, reduced safety on roads). The minutes from a March 2013 meeting of township supervisors, posted at the community center in one of the local townships, displayed concerns about shale gas development due to traffic problems on winding roads and trucks getting stuck in mud and needing chains.

2. Towanda

My second study site in PA was the county seat of Bradford County, the county in PA with the largest number of gas wells. As I approached Towanda from the north, I noticed a huge new apartment building, a billboard for a hotel opening soon, and a large sign that read "Got Land? Sell your minerals, all or part. We buy them! [phone number]". Signs also advertised metal and machine shops doing work in the "oil and gas field". The borough of Towanda itself consists of several blocks of residential development and a bustling main street with numerous businesses, even franchise fast food restaurants. The municipality has many large, beautiful old homes. Nevertheless, the built up area is spatially contained; a forested hill, visible from downtown, closes in the borough from the east; just outside of town lie farms nestled amongst patches of forest.

In the downtown, there is incessant traffic, with a huge buildup at the two main traffic lights when I was in town. I parallel parked for several minutes, watching the cars and (mostly) trucks creep by. Arizona, Mississippi, Texas, Oklahoma, and Arkansas plates passed. As I left town, I became caught in a stampede of trucks – ten or more headed each way. On these small county roads, I literally saw asphalt breaking off and rolling away as the large, gas industry trucks drove on. I had to drive partially into a ditch more than once to allow a truck 150% the width of a single lane (hauling drilling equipment) to pass.

3. Damascus

My final study site in PA, Damascus, had no town center; it consisted of homes and a couple places of business scattered on and near the Delaware River, which forms the border between NY and PA. This was my only PA study site with lawn signs about shale gas development (all signs were in opposition; many were the same signs that adorned lawns in NY). This is also the only community in which drilling had not yet occurred (due to weak geological potential for development). I read through the minutes of several meetings on shale gas issues at the township hall. In 2011, there was a large controversy over whether the community could use zoning to limit areas where development could occur.

In the meeting minutes, a range of environmental and social impacts were cited as concerns related to development; possible decreased property values were also mentioned. Township residents spoke against industrial development and several mentioned "rights" being violated by shale gas development (e.g., to peace and quiet, to clean air and water). The minutes also revealed this issue was divisive for the community, splitting neighbors. One resident was recorded as saying, "You're creating conditions where you're pitting neighbor against neighbor, and I think it's really, really disturbing." In the meeting minutes, most residents spoke against development, but the township board eventually supported development. Some of those in opposition came from across the border in NY. The major environmental group opposed to shale gas development in Damascus – Damascus Citizens for Sustainability – is based across the river in NY.

C. Communities in NB

1. Doaktown

Doaktown is in the center of the 2.5 million acre gas development lease that the New Brunswick provincial government negotiated with Southwestern Energy (or "SWN"). Minimal seismic testing had been done in the area by the time I conducted my interviews, so development potential was uncertain. This small village of less than a thousand people is located on the

Miramichi River, which is important for the community due to seasonal tourism related to the Atlantic salmon fishery. The community is about one hour from the nearest city (to the north or south) by car, and there is little more than forest in a thirty minute drive from Doaktown. The largest industry in town is the two remaining lumber mills (several have closed). The population level has declined over the last several decades and the unemployment rate is currently very high (35%). Some restaurants, a gas station, a grocery store, and a few other places of business populate the main road through the village. The Tim Horton's on this road was said by many to be main gathering point in Doaktown.

2. Richibucto

Richibucto is a slightly larger (in population) town on the Atlantic coast. The fishing and lobster industry is still alive in this town, but Richibucto is also heavily reliant on tourism and has something of a seasonal economy. The majority of residents are native French-speaking; Richibucto lies in the heart of Acadian (Francophone) New Brunswick. The town is just a few miles south of one of New Brunswick's two national parks – Kouchibouguac. In and around Richibucto, numerous signs opposing shale gas development grace front yards (I noticed no signs in favor of development). Most signs simply read "Say '*NO*' to shale gas" or "*Non* au gaz du schiste". Other signs read "SWN go home" or the equivalent in French. Not all residents locally are against development, but the majority seems to be; only the anti-development residents have mobilized. The town is not urban by any means, but does contain a commercial main street for a couple blocks directly on the Atlantic Ocean and several blocks of residential housing. The area comprises the far eastern end of the large SWN lease; the town mayor mentioned to me that substantial shale gas resources are believed to exist locally.

3. Sussex

My final study site in NB, Sussex, is the largest, most suburban of any of my nine study sites. The community has several blocks of commercial development and some large stores

(e.g., Wal-Mart), multiple hotels, and a hospital. A regular stream of traffic passes through the town (not due to shale gas, simply due to the population size). Nevertheless, once outside of the town, the landscape becomes quickly rural. A major potash mining operation is less than ten miles away; this mine has a history of causing subsidence and water contamination. The area outside Sussex is also the only area in the province where gas extraction via hydraulic fracturing has occurred (mostly in sandstone, as opposed to shale). About thirty wells were drilled and fractured locally; some were fractured with liquefied propane instead of water. My interviews in this community were with residents of Sussex proper, but also with several individuals living in the rural areas surrounding the municipality.

III. Social Representations from Interviews

I spoke with people who played a major role in shaping or facilitating conversation on shale gas development in the nine aforementioned communities. Some of the impacts that revealed themselves as important in the newspaper coverage were also repeatedly referenced in my interviews: water quality and volume, jobs, economic growth, traffic, road conditions, and health impacts. The representations of shale gas development most frequently mentioned in the interviews, however, related more broadly to social impacts that were only sporadically mentioned in newspaper coverage, such as effects on community character and ethical considerations, particularly procedural justice. Other dominant representations related to the discourse about development and did not mention impacts at all (e.g., representations of other people being misinformed about development and representations of local history being important for determining support/opposition for development).

A. Representations of impacts associated with shale gas development

Previous research on public perceptions of shale gas development asserts that beliefs about impacts are particularly important for understanding views of shale gas development (e.g., Brasier *et al.* 2011, Jacquet and Stedman 2013, Kriesky *et al.* 2013, Ladd 2013, Schafft *et al.*

2013, Theodori 2009, Theodori 2013, Wynveen 2011). This claim is based on empirical data that demonstrates strong correlations between support for / opposition to development and beliefs about impacts, as well as theoretical insights from academic literature on natural resources "boomtowns". For these reasons, in my interviews I kept careful track of references to impacts associated with development. Impacts were not the most frequently cited representations or the representations that interviewees discussed most extensively, but some impacts were acknowledged in multiple interviews. The ways in which my interviewees discussed the most frequently cited impacts follow.

1. Water (quality and volume)

Shale gas development's potential effects on water quality and comments about the volume of water used were *mentioned* by many interviewees, but, surprisingly, few interviewees featured water as a *major* topic of discussion in our conversations (i.e., it did not feature in a large percentage of any conversation). A county planner in Tioga County, NY, and the mayor of Richibucto, NB, both mentioned that water concerns related to shale gas are heightened in their areas due to all drinking water coming from groundwater sources. A resident of Sussex, NB, and a resident of Dryden, NY, expressed concerns about water contamination, due to horses and dairy cattle needing clean drinking water. In Doaktown, NB, residents were concerned that shale gas development could contaminate the river and damage the Atlantic salmon fishery; they had heightened concerns about water contamination because major aquifers in the province had not been mapped adequately. In Richibucto and Sussex, interviewees voiced concerns that the government had not yet discussed publicly or released a plan for how wastewater associated with prospective shale gas development would be treated and disposed of (only one facility for treating such flowback water currently exists in the area, in Nova Scotia). In Sussex, there is also substantial history with a potash mine breaking into the local aquifer, contaminating water, and causing wells to run dry. This history was drawn upon in discussions of potential effects of shale gas development.

The quantity/volume of water used in hydraulic fracturing came up relatively more often in interviews than in the newspaper articles. A resident of the Pine Creek Valley, PA, disclosed that the volume of fresh water being used to stimulate gas wells was a concern for some people locally. More passionately, one interviewee in Sussex asserted that it is "immoral" to use (waste) clean water in such volumes for hydraulic fracturing when water shortages exist in many places throughout the world. A leader of an environmental group in Damascus, PA, explained that issues of water volume have been linked to "sustainability" locally. The mayor of Richibucto also mentioned water volume as a concern expressed in local discourse.

While most references to water were from individuals who identified as explicitly anti-development, or at least who had reservations and were concerned about development, a few pro-development interviewees spoke about water. A municipal official in Doaktown and a resident of Sussex explained that the amount of water used in hydraulic fracturing is really a moot point when compared to the amount used in other industries and residential/commercial applications. Other interviewees acknowledged the potential for contamination, but emphasized the need for stringent standards and best practices to protect water resources. A pro-development town supervisor and leader of a landowner coalition in Sanford, NY, commented about shale gas development, "We are talking about water and air, the two most important things in life." He saw the need to protect these fervently, but did not view such protection at odds with development. A township supervisor in the Pine Creek Valley recognized that some small spills do occur, but observed that all spills in his area have been quickly cleaned up and have left no residual contamination.

While water-related issues did not feature prominently in the interviews themselves, several interviewees wrote something related to water on their word association sheet I handed them at the start of the interview. Additionally, one of the most common signs opposing shale gas development in NB depicts a personified angry water drop holding a stop sign that reads "NO shale gas!" (see Illustration 5.1). This is one example of a larger theme that emerged across my interviews. People often began by mentioning SR commonly manifest in the newspaper, or

heard in public meetings, but then their focus often shifted for the majority of our conversation to more nuanced social issues that less frequently appear in public discourse.

Illustration 5.1: The Angry Water Drop (common sign in yards and protests in New Brunswick)

2. Economic impacts

a. Jobs

The dominant economic impact that interviewees mentioned was job creation. Almost universally, this potential effect of shale gas development was linked to the goal of stemming population decline locally and retaining local children in the community with the promise of good-paying employment. An interviewee from Damascus, who writes blog posts for Energy In Depth (an industry group), cited job creation in Bradford County, PA, as keeping kids locally by offering solid jobs and creating increased economic diversity. An interviewee from Dryden heavily involved in a pro-development group cited a relatively high poverty rate in Tompkins County, NY, mentioning that he sees poverty constantly, working for a local food pantry; he believed that good paying jobs from shale gas development could help alleviate this situation. He also discussed the addition the jobs and royalties could make to the NY state tax base.

A graduate student from NB who conducted his master's research on public reactions to shale gas development in Acadian NB listed high unemployment rates, a desire to stem migration from the community, and the high provincial debt as economic rationales he heard for

supporting shale gas development. A village elected official in Doaktown explained that NB is economically depressed and losing many manufacturing and extractive industry jobs – the employment that composed a large share of the local economy previously. He emphasized that his major concern for the village is how to keep jobs in the village after the lumber industry dies away (there were previously as many as 60 lumber mills in the village; now there are two, but they still provide over one-third of the local tax base). The mayor of Doaktown built on these assertions and commented that the province is several billions of dollars in debt, which shale gas development could alleviate. He also cited the ability of the gas industry to create jobs in other industries locally (the multiplier effect).

The mayor of the village just north of Doaktown (Blackville) also highlighted the potential for shale gas development to create jobs in industries beyond the natural gas industry. He pointed out that in his community's past, local residents fought other projects that brought in new jobs (e.g., a local prison), but now most residents welcome the employment. This mayor additionally explained that jobs related to shale gas development would be year-round, whereas many of the jobs related to tourism associated with the Miramichi River are seasonal. The salient economic themes in Doaktown resonated with two pro-development individuals I interviewed in Sussex (one worked for the gas industry). These men identified creation of jobs for locals, contribution to taxes, and the multiplier effect as reasons for supporting development.

Most statements about jobs simply were expressions of how badly good-paying employment was needed (e.g., to keep children local) and in no way touched on the longevity of those jobs within the community. Nevertheless, at least two pro-development interviewees explicitly acknowledged the likelihood that jobs created by shale gas would be temporary, but still declared support for the industry. The leader of a landowner coalition in Damascus divulged that she used to be a teacher and she knows that about 50% of students in the local school received reduced lunch rates. She reflected that even temporary jobs are employment. The village councilor in Doaktown put it similarly, "[Shale gas development] may only bring a limited number of years of prosperity, but if so, then so what? It's still something."

b. Retaining farming and an agriculturally-based society

Another economic representation associated with shale gas development is its capacity, through lease and royalty payments, to allow farms to stay in business and not be sold off in pieces. Due to differences in ownership of mineral rights between the USA and Canada, this representation was manifest only in NY and PA interviews. The Tioga County planner offered this as a major factor shaping discourse in her county. An anti-development interviewee from Van Etten explained that some people in her community long for the past when agriculture was more vibrant and when the main street in the village had several shops; some residents think shale gas development can herald a return of that age. The town supervisor of Sanford explained how over the last several decades, the number of farms in his town had dwindled substantially, from 150 farms to two active farms today. He saw the money that came to about 500 local landowners from a major gas lease deal as a blessing that could sustain the remaining agricultural land and retain other open space. An anti-development interviewee in the Pine Creek Valley echoed the representation of shale gas saving farms when he expressed his dismay that local residents will often say they are against development, but they will lease anyway with the expressed purpose of needing the money to "save the farm". Likewise, a couple who live in Sanford recounted their conversations with locals when they explained that residents are apprehensive about the environmental problems, but seek leases none-the-less for the badly needed lease (and potential royalty) payments.

c. Local business and tax base

A township supervisor in the Pine Creek Valley explained that local businesses (e.g., restaurants, machine shops, supply stores) have benefited from the gas industry, but that housing (availability and price) has not been affected much because gas workers do not want to live in his township due to poor cell phone coverage. He also explained that the state impact fee has created a windfall for his township's budget; the township collected $500,000 from the impact

fee in one year, when their annual tax base is less than $50,000. He noted, however, that the amount communities receive and the impacts that they need to fund out of this largess vary substantially across the landscape, and that the impact can be a windfall or a small check that does not cover related expenses.

The foregoing representations indicate that economic effects of shale gas development discussed in my interviews were almost always linked to achieving an important goal for the community (e.g., retaining population, especially children; allowing for continuation of farming as a way of life; contributing to the tax base, which funds necessary local services). This reflection will be important later in this chapter when I discuss the substantial focus on representations related to community character and way of life.

3. Economic skepticism

Another major social representation related to economics was expressions of skepticism. Some people cited actual negative economic effects, for example, damage to property values of homes and to the real estate market (cited by: a leader of an environmental group in Damascus, a leader of a concerned citizens group in Richibucto, a resident of Sussex, several members of the anti-development focus group in Sussex, and a township supervisor in the Pine Creek Valley). Other residents, particularly in NB, offered concerns that no studies had been conducted that could convincingly demonstrate the positive economic impact that was supposed to occur. A resident of Doaktown and former provincial government official expressed this sentiment and stated his belief that "the province lacks vision and imagination for dealing with its financial situation". He was concerned that resource extraction seemed to be the only way in which the province could envision an economic future.

The mayor of Richibucto acknowledged his constituents are concerned that the supposed jobs connected to shale gas development have not been convincingly shown to exist. He also highlighted that the provincial government has already leased land, but has yet to detail what royalties it will collect from the industry or what share of those royalties will definitively return

to the communities in which development occurs. Another resident of Richibucto expressed concern that the royalties will not actually accrue to local communities and/or residents. Members of the focus group in Sussex spoke about royalties from experience, noting that very little in royalties actually comes to landowners with gas wells (some of the focus group participants had gas wells on their land); this group also unanimously agreed that substantial job creation due to shale gas development is a "myth".

The graduate student who researched reactions to shale gas development in Acadian NB confirmed resident concerns that the jobs have not been shown to exist and that crowding out of other viable industries (particularly tourism on the coast) could occur. A leader of an anti-development citizens' group in Richibucto also mentioned potential crowding out. A Damascus resident echoed NB residents' concerns that crowding out of extant local commercial opportunities is a real possibility. Another Damascus resident explained his view that local industries could theoretically benefit from a multiplier effect, but that few industries actually exist locally to take advantage of such opportunity.

In NB, interviewees were also concerned that the government was intending to sell off valuable resources too cheaply. The province owns all mineral rights, but these rights are actually held and managed by the province in the interests of its citizens. Two residents of Doaktown shared this view; one likened the handing away of mineral rights to the gas industry to the "guy who went to market with his cow and came home with the magic beans" – selling off a valuable commodity for a dubious promise. Both men were concerned that the provincial government will not use well the little money it does receive from industry.

In addition to mentioning negative economic effects and dismissing supposed positive economic impacts as not likely to occur, another representation of economic effects was that any such impacts would be ephemeral. A Doaktown resident spoke to the need to avoid the boom-and-bust cycle that development often engenders. Another Doaktown resident pointed to the necessity of a long-term vision. This interviewee contended, "People are so desperate for jobs, they cannot see the forest, due to the trees" – illustrating his belief that a focus on creating short-

term jobs is a myopic vision of development's effects. A Sussex resident similarly declared that the jobs from shale gas are not long-term, most do not go to locals, and after the initial development phase, most jobs end.

A final representation that fits under the umbrella of what I have called economic skepticism was a questioning of the assumption that economic development is a major necessity in these communities. A Doaktown resident put it this way, "Is life about having as much money as you want, or enough to get by?" He contended that some local residents favoring development sought by it to become "obscenely rich". A resident in a small unincorporated area outside Richibucto reported, "most people here understand poverty well enough that you can't buy them with a job" – acknowledging poor economic conditions, but not linking this to a need for development.

Representations of economic skepticism reflected a tendency in interviewees that extended beyond this category of SR – interviewees would commonly assert that evidence is lacking to verify the existence of particular impacts (i.e., impacts that would damage one's case for supporting/opposing development). For example, people opposed to shale gas development were quick to note that studies verifying economic impacts were few and unconvincing. Naturally, pro-development interviewees made similar claims about research showing substantial environmental contamination and health effects. I discuss this more below under the representation of misinformation.

The final representations of economic skepticism that I present above, like the representations of economic benefits, highlight that while representations contain supposed economic effects, they often speak more fundamentally to beliefs about a way of life that needs to be fostered. Whereas some SR of economic growth reflected a desire to return to a previous state of existence in a community in which populations were not declining and farming dominated the local economy, some SR of economic skepticism reflected the belief that there is nothing wrong with having very little and needing to scrape together a living. Ultimately, different characterizations of "the good life" motivated many economic representations.

4. Road quality and traffic

The issue of road quality, traffic, and the effects on well-being incumbent with a heavy increase in traffic were most frequently cited in my PA interviews, particularly in those areas where development was occurring at full tilt. A township supervisor in Pine Creek Valley identified the high level of traffic and noise on the state highway in his township as the primary concern associated with shale gas development in his jurisdiction. Recall that virtually all of the drilling in this area occurs on mountain tops in state forest, exposing residents to few effects other than traffic and associated impacts. This supervisor reported that the gas company operating locally did a good job of refurbishing the roads.

The supervisor of a neighboring township mentioned that the local roads are falling into disrepair quickly, and that while the gas industry does repair the roads, the main construction season is also the main vacation season (many of the homes locally are hunting camps or second/retreat homes). The roads in the Pine Creek Valley are small and winding. The second supervisor observed that the weight of the trucks and the volume of traffic are far too high for what the infrastructure can sustain. A resident of this region explained that even if road quality issues are addressed, this does not affect the incessant noise from truck traffic. During my 90 minute interview with this man, who lives some distance from the road, I heard large trucks constantly rumbling down the state highway. Especially when the weather is warm, this interviewee expressed how disruptive the noise is when one must open the house windows. Safety was also a concern for this man, who cited a couple local deaths from accidents with gas industry trucks and his constant fear when pulling onto roads with poor visibility. He summed up his impression of the industry's entrance into his community by noting, "they came like thieves in the night" – they were unheard of, and then suddenly, the peace and quiet he cherished were stolen away.

A resident of Van Etten reflected similar concerns about noise from heavy truck traffic potentially ruining the peace and quiet that she enjoys in the community; she also cited many

local residents she spoke with who volunteered these same concerns. Also in NY, two residents of Sanford (one pro-development and one anti-development) indicated their belief that increased traffic and related noise are the major reasons local residents are concerned about potential development. The anti-development interviewee expounded, "We moved up here to have what we have now. We do not want the rigs and traffic infringing on our way of life." When I asked her to clarify "what we have now", she pointed out the window of her home to the Delaware River that ran through her front yard and stated, "the river, hills, valley, water, birds, trees; the beauty." While traffic and effects on roads was less commonly mentioned by NB interviewees, one Richibucto resident did point out that no comprehensive examination had yet been done of the potential effects of increased traffic on local infrastructure and community well-being.

While a relatively small number of interviewees cited traffic and/or road quality as key representations of shale gas development, a substantial proportion of interviewees who did mention these representations connected them to concerns about noise and diminution of peace, quiet, and beauty. As with economic representations, views about one's desired way of life and what the community *should be* motivated interviewees to identify particular representations as relevant.

5. Health impacts

The graduate student who studied reactions to shale gas development in Acadian NB mentioned that concerns about water and air were the major issues residents had with development, and that water and air contamination were constantly tied to their potential effects on human health. While interviewees in NY and PA also cited concerns about water, air, and other environmental contamination, rarely did they explicitly link these to concerns about health. Perhaps the connection is implicit, but air and water contamination could be a problem for many reasons beyond human health effects, for example, diminished aesthetic beauty, effects on wildlife, or reduced opportunities for outdoor recreation.

A Damascus resident opposed to development even acknowledged that while he believes local residents are concerned about health issues from development, he perceived that few locals discuss these issues explicitly (in comparison to environmental impacts, which are mentioned frequently). One other Damascus resident referenced a study of health impacts from shale gas development in Colorado as a reason for concern, and a Spencer, NY, resident shared her belief that potential health effects were a major driving force behind opposition to development, but no other NY or PA interviewees explicitly represented health issues as an important aspect of shale gas development.

NB interviewees, especially those opposed to shale gas development, consistently referenced health issues, almost always connecting these concerns to a report written by the Chief Medical Officer of Health for New Brunswick ("Chief Medical Officer of Health's Recommendations Concerning Shale Gas Development in New Brunswick," September 2012). The Chief Medical Officer's name, Dr. Eilish Cleary, was synonymous with the report for several interviewees, who simply referred to "Dr. Cleary's report". The 82-page report highlighting potential public health risks had become a highly known document in the province.

The mayor of Richibucto explained that this document was a source which many local residents pointed to when seeking to identify and explain concerns they had with shale gas development. Two other Richibucto residents expressed their strong desires to see a comprehensive study of health impacts of development conducted, as Dr. Cleary's report recommended. At least one more Richibucto resident, several Sussex residents, and speakers at an anti-development concert/protest rally I attended near the Bay of Fundy highlighted health concerns, prominently referencing Dr. Cleary's report. With some interviewees, and at the concert, the report became synecdoche for concerns about health issues related to shale gas development. The report and Dr. Cleary likely had a substantial influence on the different representation of shale gas development as a health issue in NB, compared with representations in NY and PA.

Additional representations connected to health were related to personal conditions or mental health. One Richibucto resident voiced concerns about benzene, volatile organic compounds, and ozone due to being asthmatic and having worked as a medical social worker. A different Richibucto resident and a Doaktown resident cited stress as a potential impact from development. One interviewee expressed that he thought the happiness, contentment, and low levels of stress that characterize Doaktown currently would disappear if shale gas development came. The other interviewee was concerned about increasing anxiety in the community. Among these interviewees, stress was seen as a public health issue – again, potentially due to Dr. Cleary's report.

One Sussex interviewee and several residents at the anti-development focus group stated that while health impacts do concern them, the biggest part of their concern is a perception that industry and government initially lied to them and to their community about potential health impacts. They contended that the government and industry initially said that no negative effects could occur (and said that spills had not occurred), but then recanted later. There have been many reported health issues in the area near the mines outside of Sussex, and near the natural gas wells; these issues have often been blamed on industry activity. Lung ailments have existed at higher incidence rates near Sussex than in other areas in the province and some residents are suspect of government for not investigating whether industry is culpable. These residents, suspicious of government and industry due to seeing their concerns dismissed historically, commented that potential future health ailments related to shale gas creates "constant stress". They also strongly voiced a perception that their "rights" to good health have been violated by the industry and the government that failed to protect them. For these residents, government and industry were in collusion; neither could be trusted due to its sole interest in making money.

The only positive representation of shale gas development related to health impacts came from a village councilor in Doaktown and the president of the local chamber of commerce near Sussex. Both men explained that shale gas development could keep population levels high and

enough, and support a robust tax base, which would allow for medical services to remain open (i.e., a new health clinic in Doaktown and the hospital in Sussex).

6. Outdoor recreation

A category of impacts mentioned sparsely in newspaper coverage, but slightly more frequently in interviews was effects on outdoor recreation. Unlike the impacts cited above, the representation of effects of shale gas development on outdoor recreation opportunities was not clearly positive or negative. The two township supervisors in the Pine Creek Valley, who both hunt, shared their views that hunting opportunities improved with shale gas development, due to the creation of a more diverse range of habitat types (e.g., early successional habitat that grows along pipeline corridors). One supervisor also commented that outdoor-related tourism in his area is thriving as well as ever. The other supervisor explained that some local residents initially saw development as a threat to eco-tourism, which had been actively promoted in the Pine Creek Valley by the state a decade earlier, but that by 2013, many residents accepted the co-existence of gas development and environmental-related tourism.

While the supervisors cited positive effects on hunting experience and on diversification of habitat, which improved conditions for wildlife, a Damascus resident and another resident of the Pine Creek Valley mentioned forest fragmentation and habitat loss as concerns due to shale gas development. The Pine Creek Valley resident also cited wildlife being killed directly by the large increase in truck traffic. He furthermore contested the idea that hunting had improved by pointing to a decrease in out of town hunters coming to the area. This effect on non-local hunters was confirmed by (currently unpublished) research from a graduate student at The Pennsylvania State University, who surveyed hunters in the state forests of the Pine Creek Valley. A Sussex resident also contended that gas well sites limited local hunting opportunities. The presence of shale gas wells predominantly on mountain tops in the Pine Creek Valley removed the effects of development from many, but did close off roads, paths, and wilderness

previously used for ORV/ATV and snowmobile recreation, and used by those hikers who venture farther up the mountains.

B. Ways in which interviewees heard about shale gas development

Many representations offered of shale gas development were not related to direct impacts (or at least not related to the environmental, economic, and social impacts frequently cited in the newspaper coverage). Before I examine the representations that dominated my interviews, however, I review the ways in which interviewees obtained information and representations of development. These fora for emergence of SR help explain why some of the representations took shape as they did.

Essentially every way in which one could become informed about an issue was cited by at least one interviewee. Attending meetings, readings newspapers, talking to friends, reading publications by local groups (environmental groups, citizens' organizations), and finding information on the Internet were key sources. Very few if any interviewees explicitly referenced radio and television, although some broadly mentioned "mass media". Noteworthy differences surfaced between common information sources in NY, PA, and NB. Word of mouth seemed to be particularly important in PA. Public meetings were cited as mostly useless by multiple interviews in NY and NB. The Internet, while used across study sites, seemed omnipresent for gathering information in NB.

1. Word of mouth

Two NY residents (Dryden and Sanford) explained that some of the most fruitful conversations about shale gas development occur at the "kitchen table". People trying to learn more about the issue gathered together in one person's home and shared bits and pieces, facts and stories they had collected. The people sharing such incipient knowledge were described as leaders of local groups. Those individuals then tried to share their inchoate synthesis of data and anecdotes on shale gas development with their communities, making local groups a relevant

information source, particularly in Dryden, according to the town supervisor. Word of mouth knowledge that was passed on via local organization meetings also contributed prominently to discourse on development in NY and PA (some of these groups were focused on shale gas, but they also included previously extant groups like the local Kiwanis Club).

At least seven interviewees across NY, PA, and NB mentioned door-to-door information sharing in their communities (both from anti-development and pro-development sources). One Pine Creek Valley resident explained the power of face-to-face conversation by stating, "Our community meetings [about shale gas development] take place out by the dumpster, by the mailbox, on the street." Another resident in this Valley cited the "rumor mill" and the "grapevine" as key sources: "You would not believe how fast information moves in a community this small."

2. Internet

The people I interviewed were highly engaged in the discourse on shale gas development; they were municipal leaders who felt an obligation to be informed on the topic or they were activists (both pro- and anti-development) who wanted to share their message locally. Many looked to the Internet for the information that they then shared with others.

A PA environmental group leader, the mayor of Doaktown, and residents from Richibucto and Sussex cited using the Internet to find technical research on shale gas development. The PA resident stated that due to living in a rural area, the Internet is his best source for information. He searches the web daily for information and sends it to groups with which he is involved. A Richibucto resident mentioned receiving daily e-mail digests from her friends and colleagues with a series of English and French news articles about shale gas. One PA resident mentioned looking to local groups and the Internet, but dismissed the local groups noting that they are all partisan.

In my NB interviews, residents constantly cited the Internet as a key information source. Many interviewees explained that the Internet was their only option for information because all

the English newspapers and some of the French newspapers in the province are owned by a powerful industry family that conducts most of the forestry in the province and owns the largest oil refinery in Canada. Residents concerned about potential impacts from development did not feel they could turn to the Irving family-owned newspapers for accurate, unbiased coverage (see the "hostile media effect" representation below for more on this theme). A Richibucto resident expressed, "If it were not for the Internet, no one would know anything about this [shale gas development]." A Sussex resident contended that unlike the Irving newspapers, the Internet was able to provide multiple perspectives.

Another Richibucto resident divulged that the newspapers in NB are not the only concern; he cited the provincial government as equally "worthless" for offering balanced information about development. Numerous interviewees echoed his sentiments (both pro- and anti-development) (see the "history" representation below for more on this theme). He offered that the government almost exclusively mentions jobs and the economy when discussing potential development; he cited this as the rationale for citizens groups forming – "to focus on the topics that the government leaves out". Those groups obtain much of their knowledge from the Internet; this same Richibucto resident exclaimed, "We would not be where we are [on this issue] without the Internet. It has collapsed the industry." The nuanced mayor of Richibucto explained the mistrust of government information this way, "Maybe it [shale gas development] *is* great for the province, but the government moved too quickly, and it seemed to not care for our people or their health. The people, disenchanted, went on the Web, finding sensational information. Now it is hard for people to obtain objective information."

The mayor highlights a prescient (and, for me, somewhat concerning) realization – that the Internet is highly partisan as well. Of course, some online news articles can provide good coverage of shale gas development, but many interviewees cited using tools such as Google searches, which could (and do) turn up anything. In NB, the partisan nature of Internet information was even more explicit, in that several interviewees (anti- and pro-development) cited looking to Facebook groups as platforms where information is shared. Even to the extent

that Internet information is accurate, the Internet provides an excellent means for selectively identifying information that speaks to a limited range of representations and only confirms all of one's *a priori* conceptions of what shale gas development is, and what effects it may have.

3. Specific "big names"

A final means for obtaining knowledge and beliefs about shale gas development that interviewees cited repeatedly was the act of looking to specific key individuals. This was more common for residents concerned about potential impacts, and for interviewees who were explicitly anti-development, than for pro-development individuals (potentially due to more outspoken big names existing in opposition to development than in favor of it). Under health impacts (above) I discussed how Dr. Eilish Cleary became a household name amongst residents in NB concerned about development. Likewise, in NY and NB, Cornell University Professor Anthony Ingraffea was cited by name in at least ten interviews. (In an interview with one pro-development individual in Sussex, he mentioned to me that he asked some of his friends to also meet with me, but they would not because I was from Cornell, the same institution as Ingraffea. Sussex is 775 miles and a national border away from Cornell University.) An environmental non-profit organization leader in NB explained invocation of big names in the shale gas debate this way, "People crave champions for their side, especially people with academic credentials."

This use of single individuals who have made a name for themselves in the shale gas debate as key information sources disturbs me for many of the same reasons that excessive Internet use is unsettling. I have heard Professor Anthony Ingraffea give several presentations on shale gas development; while what he says is nearly always accurate, his presentations lack nuance, neglect to even mention in passing the vast majority of impacts associated with development (both positive and negative), and introduce numerous red herrings. Ingraffea has built strong academic credentials, but he is also a self-identified activist on this issue. A Van Etten resident mentioned Sandra Steingraber as a key information source. Like, Ingraffea, Steingraber has academic credentials but is also a vehement activist on this issue. Several NB

interviewees similarly cited the economist Deborah Rogers and the mayor of Dish, Texas, Calvin Tillman.

Perhaps more of a problem than activist academics who use their credentials to allow them to speak on areas outside of their academic expertise (e.g., engineers or biologists speaking about social impacts or ethical valuation), is the selective information seeking that occurs when residents gain knowledge from "big names". This can approximate information seeking on the Internet. Even individuals like Dr. Cleary, who actually stay within their areas of expertise and speak in a reasoned way to impacts they are competent to evaluate, only speak to specific effects associated with shale gas development. Dr. Cleary can and does offer an excellent understanding of health impacts, but people who primarily look to the big names focus on some representations to the exclusion of others. This same phenomena could be used to describe people who go to industry sources as their primarily information outlets (e.g., a Doaktown municipal official who identified SWN as not a great information source, but better than his other options).

4. "Useless" information sources

In addition to interviewees identifying certain sources as useful, they were quick to name other sources as useless. Across all jurisdictions (NY, PA, and NB), pro-development individuals voiced hostility for people who do not live locally coming into their community to push an anti-development agenda. In NY and PA, no interviewees cited groups external to the community as key helpful information sources. One exception in NB came from multiple interviewees who valued a consortium of twenty-nine concerned citizens groups located throughout NB that has monthly conference calls to share information across the province.

Perhaps the most commonly referenced failure in communal discourse was public meetings. While many interviewees discussed gaining useful insight at partisan meetings (i.e., meetings where everyone either supported or opposed development, such as meeting about a land lease deal, or of an environmental group), fora that brought together opposing sides on this issue often degenerated into unproductive shouting contests. One Sanford resident reflected on

the (lack of) productivity of public meetings for sharing information by asserting, "If I want to go to a yelling match, I go to the bar, I do not need these meetings for that."

In Doaktown, the village councilor explained that there have been many public meetings locally, but he contended, "They have been hijacked. People just hollered and screamed." He likened these meetings to filibusters. Another Doaktown resident agreed that meetings are not useful for learning about development; he contended that "the best ideas are exchanged in Tim Horton's". A Sussex resident lamented public meetings due to the propensity for ad hominem attacks; she noted that she will no longer attend public meetings due to constant personal attacks and a lack of substantive discussion. Repeatedly, interviewees painted public meetings as little more than fora to re-circulate and reify common positions on development, with an unhealthy dose of poorly-expressed animosity.

C. The most frequently cited social representations (i.e., the "soft" social issues)

By "soft" social issues, I mean difficult to quantify social impacts that were rarely mentioned in newspaper coverage, but that dominated my interview conversations. Even in discussions of water, economics, traffic, and health, it was clear that the reason these impacts were relevant for many interviewees was because of their views on what constitutes an enjoyable way of life and good community character. Some people clearly thought that pristine environmental quality and stunning aesthetic beauty, which allowed for peace, quiet, low stress, and inner happiness were the most essential aspects of a community. Others felt that preservation of the historical agricultural character of the region was paramount. A third group saw retention of youth as the main characterization of a vibrant and flourishing local community.

1. Community character and way of life

Almost every interviewee mentioned something that falls within this category of representations. Under the broad aegis of community character, interviewees asked weighty questions such as "Why do people live here?" and "What is this place about?" Representations

in this category speak to whether interviewees saw development as adding to or taking away from the means to lead a meaningful life.

a. The "good life"

The main motivating factors in almost every interview I conducted were the interviewee's definition of "the good life" and beliefs about how to preserve or improve a desired way of living. Two observations I made in the field, while conducting interviews capture the essence of what I repeatedly heard from my interviewees. First, while waiting for an interview in Sanford, NY, I sat in the Cornerstone Café, drinking coffee and reading the local weekly newspaper – the *Deposit Courier*. In the front page article (24 April 2013), appeared the following quote from a Sanford resident, "All we have been doing is fighting to preserve the character of our rural area, our investments, the real and intrinsic values of the land and our quality of life as protected under the existing law." I will not reveal whether this person was anti- or pro-development. It does not matter. This is the same sentiment expressed by nearly every interviewee on all sides of this issue.

Second, several interviewees conceptions of the "good life" could be summed up by the phrase I constantly saw on the New Brunswick license plates. The plates simply read "Be…in this place" ("Être…ici on le peut") (ellipsis original). Several interviewees wanted exactly that, just to *be* in their communities; others saw a need for their communities to become something different – often a nostalgic, wistful image of their community from a more vibrant past.

b. Beauty, peace, and quiet

One answer interviewees gave to why people live in their community, and to what characterizes their community, was "beauty". The first interview I conducted was with a Dryden resident who began our conversation by stating, "I live where I do because I love this life; peace and quiet is the essence of living here. … Heavy industry would destroy all this is important in life." She lamented potential air pollution, trucks, traffic, and noise, because she loves the smell

of the air and hearing the sounds of nature. This woman had moved to her home about three decades earlier. Many people who cited natural beauty (visual, auditory, olfactory) as reasons for being concerned about or opposed to shale gas development explained that they had moved to their areas specifically because beauty, peace, and quiet characterized those communities. A resident of Damascus whose front yard touches the Delaware River disclosed that he had come to this area to vacation his whole life and had saved enough to move there about fifteen years ago. He moved for the peace, quiet, and beauty, he told me as we sat at a picnic table in his yard on a spring afternoon, listening to the timeless water flow south.

A Van Etten resident spoke with several residents of her community about shale gas development; she reported to me that many people choose to live there for the peace, quiet, and natural beauty. Many want the community to remain "as is" – for those interviewees who cherished their community and way of life, change was anathema. A resident of Sanford, whose front yard sloped into the Delaware River in uncanny similarity to the property of the aforementioned Damascus resident, asserted that natural beauty was essential; her concerns were less about water quality per se, than about what might happen to "my little piece of the world". A town supervisor in the Pine Creek Valley and another Valley resident similarly affirmed that people live there due to the peace, quiet, and beauty. The resident offered, "I came here for a healthy outdoor life, for an idyllic atmosphere. [Shale gas development] would change all of that." He likened well pad construction to an aesthetic example of hell. He also noted that he values the clean air he breathes, the sounds he hears, and the verdure that surrounds him on a 13-mile bike ride on a local path more than he values "consumption". The desire to not put a price on a peaceful, happy lifestyle was shared by many interviewees.

In Doaktown, one resident contended that his community is "about clean air, water, and peace and quiet"; he followed that the social ills (crime, drugs, prostitution) commonly associated with shale gas development do not characterize the good life. Another Doaktown resident alleged, "People come here for the quiet life, the slow pace, and the sense of community". He viewed all three as threatened by development. The first Doaktown resident

tied community character back to the major river passing through the village: "Clean air and water are the lifeblood of the region…one spill destroys the heart, soul, and identity of the Miramichi [River]. Without the river, the environment, we are nothing." The second resident supported this view: "We still have our salmon, but with shale gas, we could lose them." This gentleman also depicted development as transforming a pristine area into an aesthetic "moonscape". He explained that people come to Doaktown to retire and was skeptical anyone would want to retire in an industrial area. This resident and a Richibucto resident mentioned that many local youth go out to the western provinces to find work in the oil and gas industries and that they do not think those youth would want to come home to the same industrial landscapes they work in in Alberta and Saskatchewan.

A Richibucto resident aptly tied the discussion of beauty, peace, and quiet back to a broader representation of shale gas development – she explained that much of the discourse about development is integrally tied to values: "It's about what's important to you; we [meaning she and I, during the interview] didn't really talk about values. Here, money's important; everyone likes money. But our lifestyle is really, really important. … I think a lot of people would say no to money because they don't want to lose what they have. If it meant losing what they have, I think a lot of people would say 'no', but not everybody, obviously." This woman pointed out that a large percentage of the population in NB is tied to nature and to the land, either through living in a rural area, having a second dwelling in the woods, or working in agriculture.

Heavy industry is simply not compatible with some people's vision of what life in their community entails. Another Richibucto resident confirmed, "People here are deeply connected to the woods and the river; they value the natural environment." A resident of Doaktown alluded to these same concerns when he commented about discourse on development, "The loss of values is the most disturbing thing". He believed that traditional care and respect for the natural world were dwindling. A Sussex resident put it this way, "The rural beauty feeds our souls. An industrial landscape is a grievous insult to the people who live in the rural areas here – to the community."

c. Needed change versus keeping the community "as is"

The Van Etten resident mentioned above said it explicitly, but all of the foregoing interviewees in this section implied it – they want their community to stay "as is"; they do not want change. Desire for change and acceptance of change within one's community emerged as a fundamental factor separating anti- and pro-development interviewees. It is not quite accurate to characterize the anti-development individuals as generally averse to change; rather, more appropriately, many of them simply did not see any added value coming from change. They were happy with the status quo in their communities. The industrial presence that comes with shale gas development has the *potential* to cause water and air pollution, it *could* lead to social ills, and it *may* induce negative health effects, but it will *certainly* engender an increasingly industrial community. Above anything else, it was this certain effect of shale gas development to which several interviewees objected.

Strong values existed on the pro-development side as well, as we have already learned from the representations of economic impacts. The Doaktown village councilor summed up his concerns about population decline in the area, and the need for good jobs to keep youth local, when he exclaimed, "We are losing our youth to jobs out west; the tax base and the volunteers are going away … if we do not do something in the next 10-15 years [Doaktown] will just be a wide spot on the road."

d. Polarization, dissention, discord, divisiveness

Strong values on all sides of the debate led to a raging discourse in my study communities that was less than civil and decorous at times, and that fostered deep divisions in the communities. A major effect of the shale gas development discourse on community character was the polarization and division it fomented. An anti-development resident in Damascus lamented the "polarized conversation"; a pro-development resident in the same township cited "polarization" of the community as the first thought that came to mind when I

mentioned “shale gas development”. The Tioga County planner was also quick to highlight “polarized public perceptions” as her first representation of development. A Van Etten resident spoke of gas extraction splitting families (husband vs. wives; children vs. parents) and neighbors. The Sanford town supervisor explained how the large lease deal in his town “built walls between people, and dislike”. Other Sanford residents explained how different lease prices locally fostered discord.

A Pine Creek Valley resident likened discussion of development to conversations about politics and religion, leading to unmitigated divisiveness between family and friends. He explained in sadness how this issue has visibly strained his relationship with his parents-in-law, who live next door. The mayor of Doaktown expressed his belief that the provincial government’s initial handling of the conversation about shale gas development (which was universally recognized by all of my interviewees in NB as botched fiasco at best) led to the polarization in the province. Because reliable information was not available from the government, and trust ran extremely low, factions sought out their own information, arousing a bifurcated discourse. Another Doaktown resident cited the “divisive” debate, noting the language slung by both sides is “fierce”. He likened the conflict and social disintegration to the relations between loyalists and the independence-seekers in the English colonies (future USA) in the 1770s.

A leader in an environmental non-profit active throughout NB commented, “The social and family disintegration is one of the saddest parts of the whole issue”. A Sussex resident at the focus group bemoaned, “This has ripped the community apart; people are pitted against each other.” Another focus group participant followed that many neighbors no longer speak because of positions they have taken in the shale gas development debate. She mentioned that people will walk away from her at the post office when they see her approaching to collect her mail. Another participant (anti-development) echoed that people approach her at the grocery store to yell at her that she is ruining their children’s future by opposing shale gas. This woman’s

daughter came home from school one day and told her mom that a schoolmate said, "Your mom is a bitch that needs to shut up," in reference to her opposition to development.

The only positive comments related to the polarization from discourse on development came from a few Richibucto residents. One resident expressed that the neighbor against neighbor phenomenon was not nearly as present in his community; he accredited this to the provincially-owned mineral rights. No one stands to make millions in lease and royalty payments in NB, as in the USA; therefore, he saw the community has having more opportunity to have aligned goals. His explanation cannot be the full story, however, as division was repeatedly cited by Doaktown and Sussex interviewees. For a variety of other reasons (e.g., shared history in Acadian NB, local tourism, dependence on water for economic survival and happiness), the vast majority of residents in the Richibucto area opposed development. Some Richibucto residents even stated that the shale gas development discourse brought residents closer together by giving them something to unite against. Traditionally, the French-speaking, English-speaking, and First Nation communities in this area had not been too close, but the prospect of development brought segments of these communities together.

2. Industrialization

This theme is a specific manifestation of the desire for beauty, peace, and quiet, and the aversion to change. The graduate student who researched reactions to shale gas development in Acadian NB confirmed what I heard in my interviews – that many residents are opposed to development in this region because they "care deeply about community character and the rural lifestyle". The researcher described the value of the current lifestyle in a non-industrial landscape as "non-negotiable" for several of his interviewees. Interviewees across jurisdictions (e.g., Damascus, Dryden, Sussex) mentioned industrialization as their first thought that comes to mind when they think of shale gas development; this association was never positive.

A Doaktown resident asserted that in general, industrialization is antithetical to his existence; he contended, "Industrialization of rural New Brunswick is the ultimate disaster". A

Richibucto resident concerned about health effects voiced, "Why is heavy industry anywhere near people?" Whether due to specific potential effects on water, air, and health, or more general degradation of community character and destruction of a slow, peaceful, quiet, and nature-infused way of life, several interviewees depicted industrialization as a highly visible reason to oppose development.

3. Self-interest (greed) versus community-mindedness

Representations of some residents as selfish and other residents as community-minded reflected interviewees' views on what is best for society (as opposed other community character representations that addressed the type of society that is most suitable to the interviewee himself/herself). Numerous interviewees on both sides of the issue characterized people who think about shale gas development like they do as people who care about the community. People opposed to their views on shale gas development were greedy and self-centered. A leader of an environmental group in Damascus contended that greed is a major motivator for pro-development individuals; for them it is about "me, my money", she asserted. An industry supporter and pro-development activist from Damascus retorted that it is selfish to advocate for rules that take property rights away from the whole community. This man viewed community- versus individually-minded people as the key factor creating discord in communities, seeing pro-development individuals as the community-minded people.

One Damascus, pro-development, resident recognized that others identify pro-development individuals as greedy for money. She submitted that this is inaccurate and that she cares deeply for the land and the water. She contended, "If you truly want to preserve what we have here, the gas wells will do this better", meaning that drilling would provide enough money to allow farmers to not sell off land, which would break and sub-divide the open space that currently exists. Explaining his support for development, the Sanford town supervisor commented, "I love this area; I like to help people … I care about the land, but I also care about the people." Later he contended, "If you are looking out for yourself, you need to look out for

the community too." This elected municipal leader, who had served in his post for over thirty years, saw development as something that could co-exist with land and water protection while lifting his constituents and neighbors out of economic distress.

A resident of Van Etten asserted some local residents in her area are uninformed about shale gas development, but that others know the issues and simply do not care about the community. For many interviewees, the possibility that a resident genuinely cared for the community, understood shale gas development, and opposed their viewpoint seemed impossible (or at least, in our conversations the interviewees implicitly negated this prospect). A Pine Creek Valley resident spoke of pro-development individuals' "inordinate greed". He and a Damascus resident spoke of a "gold rush mentality". Finally, in Doaktown, one resident stated that "people will sell their souls and the environment for money". The mayor of Blackville, just north of Doaktown, agreed that "people focus on themselves, not considering the greater issues" – only he spoke from the opposite perspective, supporting shale gas development.

4. Misinformation about misinformation

The foregoing representation – about self- versus community-mindedness – is not a representation of shale gas development *per se*, but rather a representation of discourse on shale gas development (i.e., a *meta-representation*). Another set of representations of this latter nature is what I call "misinformation about misinformation". A large number of interviewees spoke of how uninformed or misinformed their opponents were about shale gas development. These beliefs about misinformation were the most noticeable and frequent piece of misinformation I heard during my interviews. The one thing that most interviewees had wrong about shale gas development was the extent of knowledge their opponents had about development and its potential impacts.

An anti-development interviewee in Damascus and a pro-development interviewee in Sanford prominently stated the exact same message, but from completely opposing sides – that people on the other side of the issue constantly yell at meetings that their side does not know the

"facts", but then the other side proceeds to never cite the specific facts of which their side is ostensibly ignorant. A pro-development individual in Doaktown contended that many anti-development people obtain information and claims from watching the documentary film *Gasland*. A pro-development Damascus resident asserted that anti-development crowds receive *Gasland* "as Gospel". While there is no doubt that people have seen this film, an environmental non-profit leader in NB and a prominent anti-development resident in Sussex explicitly mentioned how their groups avoid any reference to *Gasland* because they know the questionable authority of several claims in that film. Not a single anti-development person I interviewed cited *Gasland* as an information source. On the other side of the coin, a Sussex resident explained that the local Chamber of Commerce is actively pro-development, using arguments about potential employment from shale gas to support its position; however, when I spoke with the president of this Chamber of Commerce, it became clear that the Chamber had a more nuanced position on development that was not "pro" or "anti".

An interviewee from NB stated, "People on the other side use embellishment or lies". His perspective in this quote was almost omnipresent among my interviewees, regardless of their proclivity to support or oppose development. A number of interviewees stated that as people become more informed on this issue, they increasingly support that interviewee's position. A Richibucto resident stated that some people equivocate over their position on shale gas development due to weighing impacts on jobs and water, but that these people lack full information (implying that if they had good information, the realization that water would trump jobs would be self-evident). Likewise, a Sussex resident suggested, "If people were well educated, maybe 70% would be against shale gas" (implying that less than 70% of the population locally is opposed now, simply due to lacking information). On the other side, a pro-development interviewee in Doaktown explained, "As people learn more [about shale gas development], they see it as less of an environmental disaster". This same interviewee offered that "amongst informed people" concerns about development are substantially mitigated, compared to uninformed individuals.

I found it disconcerting that interviewees on all sides of the debate complained profusely about a "lack of understanding", a "need for good research", and an excess of "bad facts", but then cited industry or anti-fracking activists as their primary information sources. Both sources likely provide factual information and both are equally weak for obtaining any comprehensive understanding of shale gas development. Almost all of my interviewees cited specific academic studies and expressed an interest in reading academic research. My interviewees were heavily engaged in the discourse on shale gas development; their level of information seeking should not be equated to that of the average community resident. Nevertheless, these were the people who spread knowledge further in many communities and shaped the discourse on this issue locally. While a few claims that both pro-development and anti-development interviewees made were likely overstated, in approximately fifty hours of interviews I did not hear one claim about the processes or impacts of development that was outright false (although many false claims were made about the beliefs of people on the "other side").

Perhaps most revealing for the "misinformation" representation was when one interviewee in a given community would cite a person by name as spreading misinformation about shale gas development, and then I would interview the exact person named later in the day, or the next day, and hear that person speak of how the first interviewee was misinformed. In each case that this occurred (at least five times), neither of the interviewees was misinformed about development; they simply held different values as to what characterized the best future for their communities. Some interviewees could not fathom that people could realize a certain level of environmental contamination risk exists and still support development; others could not believe that that same level of risk could lead people to think that even with potential economic effects, development is not worth it. Very few interviewees recognized that fostering "the good life" (i.e., a desired way of life) was actually what their opponents were after, and that "the good life" can be defined very differently by different people (but see the "nuance and balance" representation below for a few examples of this type of reflective thought).

I do not advocate taking a "relativistic" approach to views of shale gas development. I am not asserting in this section that any view of "the good life" is fine, as long as that is what someone truly wants. Some goals and desired outcomes could be bad or wrong, and amongst all potential outcomes, some are clearly better than others. In the interviews, however, few people sought to explain what, in particular, was wrong with their opponents' views of "the good life". Instead they simply asserted that their opponents were misinformed. Creating logical arguments that demonstrate the value of one approach to fostering community well-being over another approach could have been a convincing way to support one's point of view. Nevertheless, most interviewees instead assumed that no one (or few people) who knew as much as they did could disagree with their position on shale gas development.

One (anti-development) Sussex resident advocated for an exchange where people on all sides could come together and simply offer facts on the topic, to improve understanding. He, of course, believed such an event would sway attendees to the anti-development stance, but pro-development advocates saw similar value in such an event for promoting their cause. While such an event *could* be useful, I am skeptical of its value and persuasiveness, and am concerned that it would turn into the shouting matches referenced earlier.

Public meetings are actually a strong potential explanation for why this representation of "misinformation about misinformation" exists to the extent that it does. At public meetings, angry, worked-up, highly-partisan residents speak in sound bites for a few minutes at most and then sit down. The nuance I heard in 40-100 minutes of one-on-one conversation with my interviewees cannot possibly come out in a three-minute time slot. In public meetings, the list of benefits or grievances is much more likely to be simply an enumeration of complaints or profusion of laudatory statements about impacts than a subtle and detailed expostulation of how shale gas development can bring to life or kill the vision for an idyllic community.

5. Residency longevity

In several of my study communities, the length with which one and one's family had lived locally seemed to be a structural factor affecting discourse about development. A Dryden resident, two Damascus residents, and a CBC newspaper article I read about discourse on shale gas development near Doaktown all referenced the "old boys" (or "good old boys") network as something propelling shale gas development forward. This term is a derogatory phrase used to characterize people who have risen to positions of power in their communities due to their families having lived in the area for a long time. The theme of residency longevity is another meta-representation – a representation of how other people represent development.

A woman who lived in Dryden for thirty years and was opposed to development explained that she believes some pro-development residents view her as an "interloper" who is trying to impose views and values from outside the community on the traditional community. She lamented that some locals will dismiss long-time residents such as her, due to their families not having lived in Dryden for generations. In Damascus, an anti-development resident asserted that the "landed aristocracy" – the long-time residents owning much of the property – were quick to mobilize on this issue from a pro-development perspective and to brush aside "newcomers".

A pro-development interviewee in Damascus explained her view that the "newcomers" locally form their own communities and do not want to integrate with the long-time residents. Another pro-development Damascus resident believed there was a sense of "elitism" amongst the recent migrants to the township and that those individuals who are unwilling to allow the community to change at all once they arrive are displaying "supreme arrogance". The first pro-development resident contended that shale gas development has brought her community together, but that the newcomers are the ones opposed to development. Such a comment clearly illustrates how this issue has led, in some areas, to a stark bifurcation of communities of place into two (or more) communities of interest. While the representation of length of (family) residency was a major part of the discussion of shale gas development in Damascus, Dryden, and

(to a lesser extent) Doaktown, it was barely referred to or not referenced at all in my interviews in the other six municipalities.

6. Community history

History of resource extraction and history dealing with government and industry emerged as important lens through which interviewees interpreted the potential future associated with shale gas development. History was an important factor that influenced newspaper coverage of shale gas development, particularly in the Scranton newspaper (see Chapter Four), but in my interviews, history was brought up most substantially in the Canadian communities; Doaktown, Richibucto, and Sussex were replete with stories of how the local legacy caused residents to interpret shale gas development in one way or the other.

a. History of resource extraction

The Pine Creek Valley was my only study area in NY or PA where history played a major role in my interviewees' representations. A pattern emerged in these interviews that also played out in each of the three NB communities – different interviewees relied on the same history to arrive at polar opposite interpretations of what shale gas development would mean for the community. One Pine Creek Valley resident exclaimed that the timber harvesting in his area during the preceding century left a horrible legacy of environmental destruction from which the area is just now recovering. He asked, therefore, why would the community want to go through this again? Another resident recounted that past timber harvesting left a horrible legacy of environmental destruction, but the land was so resilient that now the area has greatly recovered. He offered this as evidence that the local environment is able to sustain and bounce back from industry even more invasive than shale gas development.

Two interviewees in Doaktown cited resource extraction as part of what defines the area, invoking this past as support for continued extraction in the future. One mentioned that Doaktown is a resource-based area and that this history means people should be able to find a

balance between environmental and economic considerations. The other interviewee asserted that the community was founded on forestry: "My family has always been in forestry … The way I look at it, this community was built on forestry; that is who we are." He used this history to rationalize his support for shale gas development: "In a resource-based province, we have no choice." This interviewee, however, did also recall that the timber resources on crown land were basically "given away" to industry in the past; he expressed that he does not want that history relived. The village must be compensated adequately for the resources extracted this time.

Other Doaktown residents invoked the same resource-intensive history to anchor social representations of development, but from a different perspective. One resident spoke of the "legacy of misuse" of the local environment having a long track record in lumbering. He contended that timber operations locally should be a "wake up call" to those considering shale gas development near Doaktown. Another resident grounded this history of resource extraction in anecdotes of when tailings ponds failed in the 1950s and 1980s, killing nearly all the fish in the Miramichi River. He stated that heavy industry could lead to such effects again – something he could not support. This same interviewee rebuked those Doaktown residents concerned about (human) population decline who cite a need for shale gas development due to employment it could provide. He recalled that the historic fluctuations in Doaktown's population over time, growing and diminishing, and that the village has a history as a place that people have passed through, not necessarily staying for a long time. Therefore, he had fewer concerns than some about a dwindling village population.

b. History dealing with government

In Richibucto, multiple residents explained that the Acadian population has a fundamental distrust for government and a strong resentment toward anyone they perceive as trying to oppress them. The provincial government was perceived as only representing industry on the issue of shale gas development, which activated a history of tensions with the government dating back to the early 1800s. The Richibucto mayor further cited a 2010 deal in which the

provincial government tried to sell the provincial power authority to the Quebec government. Many NB residents felt betrayed by this deal that seemed to have been negotiated in secret, behind closed doors, and without consultation. This event, related to energy issues in the province, attuned residents to keep a close eye on whether the province was acting in their interest and listening to their concerns. Another Richibucto resident (the leader of a concerned citizens group) invoked a history of the provincial government giving out variances on environmental regulations as a reason that the government could not be trusted to protect the environment from shale gas development, no matter how strong the regulations are on paper.

In Sussex, experience with the provincial government failing to live up to its promises and not meeting citizen expectations also provoked negative views of shale gas development. A resident explained that she and others have been asking the government for seven years to conduct air quality monitoring locally to check for harmful emissions from the extant shale gas development. The government has not yet provided such monitoring. When the government then states that with expanded shale gas development it will conduct air quality monitoring, these Sussex residents cannot trust such a promise. Likewise, the promise of competitive royalty rates being charged by the province was not believed by Sussex residents who perceived that current rates basically give the gas away to industry. At the focus group I conducted in Sussex, several participants spoke of a history of water contamination in the area from the potash mine and the reticence of the government to conduct investigations, but to continually assert that no water problems exist. A resident not at the focus group stated that after the mine incident, the "rhetoric that people will be protected [by the government] if something goes wrong is no longer believable".

D. Minor representations

While not as dominant as the representations in the previous section, there were several additional representations that were not impacts mentioned in newspaper coverage, but that still framed the discourse on shale gas development. These representations were mentioned by fewer

interviewees, compared with the preceding representations, *and* the time allocated to discussion of these representations was less than for the foregoing representations, even in those interviews where they were discussed.

1. Accidental activists

Tom Wilber, the journalist I interviewed and from whom I quote in Chapter Four, wrote a book about discourse on shale gas development in NY and PA titled *Under the Surface: Fracking, Fortunes, and the Fate of the Marcellus Shale* (2012). Chapter Five received the heading: "Accidental Activists". While a couple of my pro-development interviewees were quick to chide anti-development leaders as "professional activists", at least five of my interviewees (one from Dryden, two from Richibucto, and two from Sussex) explained how *Wilber's* phrase fits them well.

The Dryden resident explained, "I am not an activist; I am a hermit. I like it that way." After she attended a few meetings and heard from other locals about development and its potential effects, however, she become "terrified", which forced her to become involved. A Richibucto resident actually offered the phrase "accidental activist" as a moniker for herself (having never read Wilber's book). She described Acadians "like Hobbits; we try to stay away from the big people", but she felt the issue of shale gas development was simply too important for her to remain quiet. Another Richibucto resident described becoming involved due to shale gas development being "the one issue I couldn't avoid". He now leads a citizens group on this topic, but stated that he does not enjoy having a public presence. A Sussex resident noted that many of the people who have fought shale gas development there since it began almost a decade ago are farmers, and that farmers are not normally civically active in that area. Finally, another Sussex resident reflected that she "would rather be home gardening" than fighting development, but that with the importance of this issue, more so than for other issues that have emerged locally, she simply "must" be involved.

2. Grassroots action

Both "professional" and "accidental" activists were essential for instigating grassroots action in my study communities. Six interviewees from as many different communities stressed the import of door-to-door efforts for spreading information about shale gas development. Residents in Sanford and Dryden spoke of efforts to make residents aware and to ask them to sign a petition requesting a municipal ban on development. A leader of an environmental group in NB spoke of a similar effort in Taymouth, a small community south of Doaktown. The graduate student who researched shale gas discourse amongst Acadians spoke of the large amount of door-to-door traffic on this issue. A Richibucto resident described "handing out CDs, videos, documentaries, leaflets, and making phone calls" to spread the word on this issue through his community.

Most of the door-to-door activity that my interviewees described was undertaken by people concerned about and/or opposed to development. Nevertheless, a Damascus resident recounted that early in the conversation about shale gas development, the long-time landowners grouped together and went door-to-door, attempting to convince residents that development was good and to ask them to enter into a landowner coalition lease deal. A Van Etten resident mentioned how she and others went door-to-door, not to share information so much as to collect information on how residents perceived potential development and how they were thinking about its effect on their way of life.

Interviewees engaged in grassroots action on this issue in ways other than door-to-door information sharing. I previously revealed that local groups, kitchen table conversations, and in-person meetings were major sources of information on shale gas development. All of these means for learning about and forming opinions on this issue point to the *social* nature of the representations that formed about development. While much of the information that people internalized about development came from university, government, or industry sources, that information was often digested and processed by individuals within a small community and then shared in that community via direct means of social interaction. This phenomenon is illustrated

well by a Doaktown resident who explained, "It may have started with a conversation at Tim Horton's; then, people work together for grassroots governance."

3. Nuance and balance

Several of the major representations above indicate a lack of nuance in how the interviewees discussed the issue of shale gas development (and especially how they described conversations about shale gas development). "Misinformation about misinformation", representations of greed and self-interest, and the nearly wholesale failure of the interviewees to recognize the massive importance to other people of varying visions for the "good life" leave one thinking that few people are talking across "sides" in my study communities, or perhaps more correctly, that few people are listening.

A minority of interviewees did show nuance on this issue and seemed to appreciate a need for balance. For some interviewees, this related to seeing a need to weigh risks and benefits of development itself. Other interviewees perceived a need to understand where each side was coming from in supporting/opposing shale gas development.

The supervisor of Cummings Township described the sentiments in his community about development by disclosing, "Most people see the whole development process as having goods and bads; there is a balance." Cummings Township has the largest number of wells of any municipality in PA and received $500,000 in impact fee payments in 2012 for its population of four people per square mile. No environmental contamination to speak of has occurred in the community and the Township has been able to do away with all municipal and fire taxes due to the impact fee largess. Social impacts are fewer in this town than might exist in other communities because few shale gas workers live in the area due to poor cell phone coverage. Therefore, major changes have not occurred in rent prices, housing availability, crime rates, etc.

Despite this community experiencing basically every benefit that pro-development advocates cite, and witnessing few of the effects that anti-development advocates bemoan, the Township supervisor showed nuance in evaluating the effects of shale gas development. He

clearly understood the rationales of people supporting and opposing development. He also mentioned his belief that distribution of goods and ills is not uniform, both within his township and across local municipalities.

The Sanford town supervisor advocated a delicate need for balance, recognizing that (1) people currently use energy, (2) they will continue to do so, (3) many different energy options are available, and (4) that one must include a conversation about the pluses and minuses of a range of energy options in any discussion of shale gas development. Another Sanford resident expressed his belief that many locals support development due to potential lease and royalty income. While he opposed development himself, he would not attack the pro-development crowd for their beliefs. He simply reflected, "They have values; they need the money too." A Pine Creek Valley resident shared this same perspective. While he stated that he "would sacrifice lifestyle for less fossil fuel use", he was unwilling to blame the people who sign leases because they really need the money.

A township supervisor in the Pine Creek Valley (not the one cited above) showed nuance by noting that there are a huge number of streams locally and many unknowns exist related to potential water contamination from development. Nonetheless, he did not immediately view this as negative, but rather as reason for caution. This man has an environmental background and, when I interviewed him, he was president of a local environmental preservation association; yet, he prevented his background from leading to overreaction. He spent his time on this issue learning about and responding to local concerns and interests.

Two additional instances of nuance that I observed did not come from my formal interviews, but from casual conversations I had with local residents – one in Doaktown and one in Richibucto. An elderly woman working at the bed and breakfast I stayed at in Doaktown and a young, sprightly bartender in Richibucto both offered similar perspectives – they were concerned about the environment due to its great value generally and specifically due to its importance to local residents, and they saw a need for jobs to give kids the option of obtaining employment locally. Then they both stated that they know too little to form a definitive opinion.

These two women did not know a lot about development, but they knew enough, and they certainly knew as much or more than many people I have heard speak on this issue at public meetings and events. The women were unwilling to jump to conclusions and they saw the importance of different outcomes for multiple segments of their community.

4. Hostile media effect

I previously highlighted how many interviewees expressed distrust for newspaper coverage on shale gas development and how people on all "sides" felt that coverage was biased against their perspective. This propensity of partisan groups to "see mass media content biased against their own point of view" has been dubbed the "hostile media effect" in academic research on communication (Schmitt *et al.* 2004, 623). While one or two interviewees invoked the hostile media effect in relation to national newspapers, virtually all the comments about mass media being biased against one's point of view related to local newspapers. Many interviewees did not mention bias in the mass media; nevertheless, not one interviewee volunteered that mass media coverage supported his/her positions and/or arguments on shale gas development.

Three hostile media comments came from interviewees in NY and PA. A Sanford resident explained that the weekly newspaper, *The Deposit Courier*, prints verbatim articles from "Energy in Depth" (a pro-development industry advocate group) – citing this as bias for development. A Damascus resident stated, "pro-gas people are boring, less visible", supporting her contention that newspapers tend to cover the charismatic and sensational stories, thus neglecting coverage of pro-development conversation in favor of anti-development claims about impending disaster and destruction. A Pine Creek Valley resident cited the *Williamsport Sun-Gazette* (discussed in detail in Chapter Four) as "very in favor of drilling", thus not being a reliable information source.

In NB, comments about bias in newspapers were more frequent. The mayor of Blackville (north of Doaktown) and the village councilor in Doaktown expressed their contention that news coverage is anti-development. The mayor stated that in the media "negative sells"; the councilor

asserted that news coverage of development is "an attention grabbing project" that focuses on dramatic (negative) potential impacts. A (pro-development) couple in Richibucto with whom I had a chance casual conversation disclosed, "This is Canada; the news media are liberal here". These contentions are in strong contradiction to the two Richibucto interviewees and two Sussex interviewees who explained that the coverage of development is always spun as pro-development due to the Irving family owning all the newspapers. One Sussex resident emphasized that this concentrated ownership allows for "no free discourse on the issue". The one nuanced comment I heard in an interview about media coverage came from a perceptive Sussex resident who elucidated that in the Irving-owned newspapers, the headlines often spin the coverage in favor of shale gas development, but the articles themselves contain arguments and facts speaking to both sides of the debate. While my sample size was not large, I looked at the front page article in the St. John *Telegraph-Journal* related to shale gas development on the day I interviewed this man and found his assessment to be accurate.

E. Ethical representations

The final important set of ways in which interviewees represented shale gas development was by characterizing development as an ethical/moral/normative issue. Although the ethical representations relate to some of the other representations (e.g., community character, history, health impacts, water impacts), the moral character of the ethical representations sets them apart. These representations are not evaluative statements about something being good or bad, they are ethical statements about what is right or wrong. The newspaper content analysis revealed relatively few ethical representations, mostly about procedural justice and distributive justice; the public meetings I have attended tend to address specific impacts far more than ethical arguments. Nonetheless, ethical assertions were prominent in my interviews. The second most prevalent of any representation, following development's effect on community character and way of life, was the presence (or lack thereof) of procedural justice in decision making on shale gas development.

1. Procedural justice (a fair process)

Procedural justice was mentioned more than any other normative issue in the NY newspapers in my content analysis, but none of my NY interviewees expressed much concern over procedural issues.[24] The only procedural justice comment from a NY interviewee came from a Dryden resident opposed to "home rule" – the ability of communities to decide for themselves how to regulate shale gas development. In contrast to most comments about the decision-making process, which generally favor direct democracy and giving local residents a voice in regulation, this resident advocated leaving decisions to "experts" at the state level who study risks and benefits related to development. One PA interviewee mentioned a procedural concern by noting that there was no process for decision making on development in PA. When gas companies started entering the state, development just began occurring. The lack of consultation in advance of development concerned her. All other comments I recorded about process and procedural justice (three dozen worth) came from my Canadian interviewees.

The lack of trust in government and the belief that government was not acting in the best interests of the citizens of the province dominated representations of procedural justice and was one of the, if not *the*, central representation(s) in many interviews. History of experience with resource extraction and history of interactions with government relate closely to representations of shale gas development as a procedural justice concern. For example, Sussex residents spoke from their years of experience with shale gas development and from dealing with the government response to environmental contamination caused by the potash mining locally. One stated that residents have seen firsthand that government regulations have no teeth and that they favor industry. Another asserted a commonly repeated sentiment that "politicians see their job as promoting industry".

[24] I define "procedural justice" in line with John Rawls's conception of "perfect procedural justice", which is characterized by established criteria for what constitutes a fair/just outcome *and* procedures that ensure the fair outcome will materialize (Rawls 1999). This definition is consistent with the ways in which my interviewees discussed ethical procedural concerns. Not consistent with the interviewees characterizations of procedural justice is Rawls's "pure procedural justice", which makes procedural considerations the *only* relevant moral factor in decision making (i.e., other normative considerations are not included, for example, the outcomes of an action or decision)

A third Sussex resident spoke of industry and government collusion, averring, "Corporations are *not* responsible; the potash history shows our flawed political system". This same interviewee contended that the government is unwilling to speak with groups opposed to industry development. I cannot, of course, know the validity of this claim, but the sentiment is a far cry from a pro-development Doaktown official who mentioned that the provincial government leaders were always on hand and willing to meet with them about development "within three weeks" of requesting a meeting. Even a pro-development interviewee in Sussex expressed, "I don't think our provincial government has the expertise to handle this" – offering his explanation for the loss of trust between some residents and the government during the initial information sharing stage on gas development.

A fifth Sussex resident opined, "Corporate practices have co-opted the system", meaning the political system in the province. This distrust of industry ran deep in a segment of the Sussex population. One resident stated that the "history of lies and poor treatment from industry is enough to oppose it [gas development], even if no additional impacts existed." This resident explained herself further, noting the bad history of residents trying to obtain recompense from contamination caused by the potash mine. A focus group participant pointedly stated, about industry representatives with whom he had dealt, "If their lips are moving, they're lying!" Another resident cited lies from industry and government about where the produced water from the gas wells is disposed of as evidence that they cannot be trusted.

A pro-development Sussex resident, a gentleman who worked for the gas industry, asserted, "As long as you have honesty and openness, you can have drilling here; then, if there is a problem, they will fix it." He affirmed that the only way forward on the issue of development is for the government to be trusted to share information. His claims illustrate clearly why for some residents there will never be a way forward on this issue. The industry interviewee was honest, genuine, and he cared about dealing fairly with local residents. A sub-population of Sussex residents perceived the vast majority of the industry in a different light. Several minutes of back-and-forth conversation between the participants in my focus group related to trust in

industry. One resident offered that the "lack of honesty and integrity" is her main concern related to future development. Others quickly responded to her statement, saying, "Just be honest! Just be honest!" And then, "They don't want to be; they can't."

Even though in Richibucto there was no local historical experience with industry, similar concerns surfaced as in Sussex; the distrust of government was palpable in each interview. One resident, a leader of an anti-development movement, described her work on this issue as a "fight against corporations and government conspiracy". The mayor described how the provincial government hurt its credibility by first misleading citizens and claiming that "everything was rosy" related to shale gas development. He also pointed to a major lack of transparency from the government in sharing information on how royalties would be assessed, who would receive royalties, and on potential environmental effects from development. He concluded a shortage of "transparency and consultation" from the provincial government were his primary representations of shale gas development.

Another Richibucto interviewee spoke of "lies" from the government about the "footprint of the industry" in the community, voiced concerns about local people not being included in the decision making process, and shared her views of government and industry "collusion". She described the government as "shilling" for industry and being "willfully ignorant" of many effects of development. "Do we trust the [provincial] government to protect us?", she asked, to which she offered an emphatic, "No!" This same resident echoed a sentiment from some Sussex interviewees when she proclaimed, "The taxpayers will always pay for disasters; industry will never pay". Another local resident used the words "corporate terrorism" to describe this perceived ability of industry to escape liability. A third Richibucto resident agreed, "Companies will never pay", "they lack all responsibility". One of these three residents identified the lack of government information and transparency on shale gas development and the "subversion of the democratic process" as her initial reasons for becoming active on this issue: "it touched on my value of injustice".

In Doaktown, a rather differently positioned community due to its pro-development leaning, the conversation about procedural issues still paralleled the discourse in the other two NB communities. The (pro-development) mayor described the province's lack of opportunities for public participation early on in the process as "a disaster". An anti-development resident described government connections to industry as "too close" and likened the information coming from the government to that of a "snake oil salesman". He averred, "The process is bereft of ethics and morality." Another resident expressed concerns that land deals with the government for shale gas leases (and timber deals in the past) have been "clandestine" – again a concern about transparency.

A final procedural concern that arose in NB was the lack of local control in decision making. In a chance conversation I had with a faculty member in the Forestry School at the University of New Brunswick, he explained that local communities have historically had very little effect on resource policy in the province. The graduate student who studied this issue in Acadian NB described how several of his interviewees were concerned that local people were speaking on this issue, but the provincial government was not listening. He recorded perceptions of a power differential between the weak local residents and the central provincial government with all the power. One Richibucto resident cited this power differential as a reason some residents chose not to become involved in the issue – due to sense of fatalism. The mayor of Richibucto mentioned that the question of what opportunities exist for local governance on this issue was a major topic of discussion between him and his counterparts in other Acadian communities. Another Richibucto resident spoke of trying to appeal to Canadian common law to obtain more opportunities for local control of regulation over shale gas development.

The incessant attacks my NB interviewees waged against "government" were all directed at the provincial government, specifically the Ministry of Energy and Mines – the entity responsible for regulating shale gas development in the province. To understand better "the other side" of this debate, I interviewed the NB Minister of Energy and Mines. Whereas my interviewees constantly characterized the government as only giving attention to economic

issues, the Minister's first three representations of shale gas development were: "economic benefits", "environmental issues", and the "social dynamic". He was acutely aware of the concerns expressed by NB residents about environment and health. He stated that to address environmental concerns, development requires the best rules with continual updating; he explained that best practices include monitoring, enforcement, and inspection. We have seen how and why these promises fell on deaf ears for provincial residents who have historically-derived distrust for the government.

The Minister was also acutely aware of the lack of trust – he asserted that on this issue few residents trust industry or the government. He cited academia as the last bastion of perceived objectivity. Therefore, he stated that he recently (May 2013) created a NB Energy Institute led by a retired professor to share independent information with the province about shale gas development. While the Minister was generally very aware of discourse in the province, his selection of the professor to lead the Energy Institute did not sit well with many NB interviewees. This professor, Dr. LaPierre, had led a study of public perceptions of shale gas development in the province in 2012, which included nine public hearings throughout the province. Many of my interviewees cited this public consultation process as a "sham" and noted that while the data presented in LaPierre's final report accurately reflected the discussion in the meetings, his final recommendations for moving forward with shale gas development were incongruent with the public comments he collected, and seemed to be heavily pro-development. After my data collection in NB was complete, Dr. LaPierre resigned from this post due to public awareness that he had misrepresented his academic credentials; this debacle further damaged trust in the NB government.

The Minister's creation of the Energy Institute as a group of academics to share information on shale gas development was a great step forward that could have eased some of the contentiousness on this issue and served as an unbiased information source. The selection of Dr. LaPierre as its leader negated any ability for the Institute to achieve its goals amongst NB

residents concerned about shale gas development. I predict little change in concerns over procedural justice going forward in New Brunswick.

2. Distributive justice

Variation in who is likely to experience which effects of development was the second most common normative/ethical representation related to shale gas development in my interviews, just as it was in my newspaper content analysis.[25] For this ethical representation, some people voiced that independent of the overall balance of good and bad outcomes from shale gas development, allowing development could be wrong if some residents disproportionately experience legitimate hardship. Other interviewees cited distribution of benefits between industry and local residents, noting that unless real benefits accrue to the latter group, development is wrong and should not be allowed.

Residents from Damascus, Richibucto, and Sussex all mentioned their belief that companies were the ones to benefit and residents were the ones to bear the costs. Recall that in Canada, residents do not have the opportunity to collect substantial lease or royalty payments. The Richibucto interviewee stated, "the costs are socialized amongst many; only the company benefits". Distributive justice concerns were equally palpable in both nations. The Cummings Township, PA, supervisor viewed distributive justice as a concern, with some residents within a community experiencing highly negative impacts from increased traffic, while other residents only benefited from improved financial conditions. He also highlighted concerns of distribution of positive and negative effects *between* communities. Likewise, the other Pine Creek Valley

[25] I define "distributive justice" consistent with the broad definition offered in the Stanford Encyclopedia of Philosophy (2014): "the distribution of benefits and burdens of economic activity among individuals in society". While distributive justice can be refined more narrowly into welfare-based principles, desert-based principles, considerations for future generations, and/or appeals to virtue (as opposed to principles), I do not include any of these sub-definitions in my meaning of the term here. Interviewees included a wide range of meanings for ethical concerns about distribution of effects of shale gas development. I find it difficult to define the term with granular specificity because frequently interviewees did not define or justify their claims and assertions related to distributive justice concerns. The broad definition captures all the meanings offered in the interviews.

township supervisor identified the "discrepancy between those who stand to benefit and those who will not" as one of his primary concerns with shale gas development.

A Richibucto resident linked distributive justice to Dr. Cleary's report on health impacts by explaining that the report mentions how the "equity of risks" needs to be considered when regulating development. Finally, a Damascus resident avowed (sarcastically) that "distribution doesn't matter because people do not matter" in her township – a reflection on her belief that newcomers to the township are not viewed as relevant when the long-time residents in leadership positions make decisions.

3. Property rights

The third most-cited ethical representation in my interviews was that regulation on shale gas development needs to account for one's rights to use (and dispose of) one's property as he/she desires. This representation was limited to NY and PA interviews due to the simple fact that Canadian residents do not own the mineral rights underneath their land. While it is possible that someone could have discussed ability to lease surface rights to drilling companies, the money that comes from surface leases is very small compared to leases and royalties for mineral rights. Additionally, no laws prevent anyone from engaging in such leases in NB.

The town supervisor of Dryden explained that many of the people against the town ban on shale gas development are opposed to the ban because of their beliefs about the importance of "property rights". The individuals do not necessarily support shale gas development; they simply oppose a ban on development because the ban restricts the ways in which residents can use their property. While many people who share the "property rights" view are conservative, the town supervisor noted that some are politically conservative but socially liberal. The supervisor noted that these people are some of the most difficult to speak with about development, as well as other issues in the town, because they continually use "property rights" as their argument against all zoning.

A Damascus resident asserted that the "old boys network" that governs the township hates "democracy and governance" because it limits "property rights" – noting that township officials have little interest in hearing from concerned residents. Nevertheless, this interviewee explained his perception that the township leaders do not mind current zoning regulations because "they wrote the rules"; only additional zoning regulations (associated with regulating shale gas development) concern them.

A pro-development resident in Damascus offered his opinion that it is not appropriate to ban shale gas development everywhere. While this is what the town board in *Dryden* did, almost the opposite occurred in Damascus. During township meetings in 2011, residents tried to have development restricted to certain areas, but the township eventually decided to permit it virtually everywhere. This interviewee also divulged that when he and other residents use a property rights argument (representation) to support allowing shale gas development, people just dismiss these arguments, they do not fight against them. This comment brought to light that I did not once hear an interviewee offer any argument against any ethical claim (i.e., not just in relation to property rights, but in relation to all of the other claims I have discussed as well).

A Dryden resident epitomized those residents who see property rights as an essential representation related to shale gas development. He cited "freedom", "liberty", and an individual's right to decide what to do with his/her property as issues of paramount importance when determining regulation (or lack thereof) for shale gas development. The Sanford town supervisor mentioned private property rights when he declared, "I have a problem with someone coming from the city and saying, 'I don't want you to do anything with the land because it is too pretty.' But they cannot pay my taxes." While waiting to conduct this interview in Sanford, I was reading over the local weekly newspaper and came across several references by Sanford residents to "rights". Rights to build (develop) on one's land were juxtaposed with rights to protect the environment.

4. Summary of ethical representations

The three aforementioned ethical representations reveal that ethical issues were important for shaping representations of shale gas development and particularly for representations of how shale gas development should be regulated. The content of the representations did not differ substantially from the normative representations in the newspaper coverage, but ethical representations played a much larger role in the overall conversation during my interviews than they did in the newspaper coverage. In one sense, this difference may not be surprising because ethical representations were rarely presented as anything more than claims; they were not something to which opponents needed to *respond* (unlike ostensible "facts"). This same rationale could explain why few interviewees spoke of other people's ethical claims – in contrast to the substantial discussion of other people's claims about impacts (see "misinformation about misinformation"). These reflections call into question whether ethical claims are truly *social* representations. Are these representations being discussed in public fora, or are they primarily developed and held in the minds of individuals? The strong presence of certain claims in specific geographic areas suggests they might be social representations, but I explore this question in more detail in the next chapter.

IV. Moving Forward

My interviews were with leaders on the topic of shale gas development – people who shaped and facilitated discourse on this issue. After hearing their views and their perceptions of the conversation about development, I sought to allow the general citizenry to characterize and offer their own representations of shale gas development. I combined my research from this chapter and the preceding one to design a survey that asked 168 questions to a random sample of residents from 34 communities across southern NY and northern PA. In the next chapter, I examine the nature of these residents' representations and the extent to which those representations may be *social*.

Chapter Six: Survey of Marcellus Shale Residents

"O that you could turn your eyes toward the napes of your necks, and make but an interior survey of your good selves!"
-- William Shakespeare, *Coriolanus,* Act II, Scene I

I. Introduction

The act of viewing, examining, or inspecting in detail – thus, the Oxford English Dictionary defines "survey". Shakespeare reminds us that a survey is far more than the stapled sheets of paper to which some social scientists refer by this word; a survey is a means for critically evaluating an unknown entity – for illuminating that which we did not comprehend. In this sense of the word, I surveyed a random sample of residents in 34 municipalities throughout the Marcellus Shale region in southern NY and northern PA. My efforts were aimed primarily at three research questions presented in Chapter Three: (1) what social representations (SR) of shale gas development exist in these communities, (2) are these SR truly *social* (in the sense of being meaningfully shaped by local context and emerging in public fora), and (3) what factors affect SR most heavily?

The three research questions guide the format of this chapter. In Chapter Three, I detail the methods I used to design, administer, and analyze the survey, and I provide a rationale for those methods. In this chapter, I begin by presenting descriptive statistics from a selection of questions from the survey. These data start to highlight some of the representations of SR that exist amongst the general public across my study areas. A few of these questions also provide understanding of the extent to which representations were *social*. Second, I compare the descriptive statistics from the survey respondents' answers with data from a non-respondent follow-up survey I conducted. I discuss the similarities and differences between the samples and provide a rationale for my approach to the remainder of the data analysis. Third, I offer a detailed analysis of the responses to an open-ended question in my survey (which elicited respondents' representations of "shale gas development via hydraulic fracturing" in their own

words). I provide some basic descriptive statistics, highlighting the most common themes that emerged from the thematically-coded data. I then present a series of correspondence analyses (i.e., graphical representations of cross-tab tables) that relate these codes to each other and to close-ended variables in the survey.

Fourth, I examine the factors (i.e., independent variables) that were the most meaningful influences on SR of shale gas development. I identify a range of social structural, cultural, demographic, personal value, and historical factors that shed light on the factors and processes that produced the SR. I also characterize the relationships between the various SR (i.e., dependent variables). I point out relationships between variables that have previously been identified as important for public perceptions of shale gas development, but that these data suggest may be weak or may not exist. In examining factors affecting SR, I rely on regressions, factor analyses, and structural equation models.

Fifth, I consider the final research question I laid out in Chapter Three: "How do social representations of shale gas development relate to support for sustainable and resilient communities?" Additional factor analyses, regressions, and structural equation models reveal the connection between beliefs about importance of sustainability/resilience and SR of support/opposition. Sixth, to examine the extent to which representations may be *social*, I compare across municipalities the major representations that I measured in the survey (i.e., support/opposition, beliefs about impacts of shale gas development, and ethical representations). I use generalized linear models to characterize the relationships between these variables and municipality. I conclude this chapter with a brief review of the findings and of how they combine to answer my research questions identified above.

II. Descriptive Statistics

A. Representations of shale gas development

My newspaper content analysis and interviews led me to include four major sets of potential SR of shale gas development in the survey: (1) support/opposition for development, (2)

beliefs about likelihood of impacts from development, (3) beliefs about effect on quality of life if those impacts were to occur, and (4) importance to respondents of various ethical considerations for regulating development. In the tables that follow, I present the frequencies and means for responses to these survey questions; for certain questions I provide additional means for the sub-samples from NY and PA (with t-tests for significant differences). All frequencies total to 100 percent (i.e., I exclude, for each question, any responses that were blank/invalid).

Two notable findings emerge from the question about support for / opposition to development (Table 6.1): (1) the data are bimodal, with the largest percentage of responses toward the extremes of the scale and (2) there is little variation in support/opposition across scales at which the shale gas development could occur (although average support does increase to a small extent as the location of development becomes more removed).

Table 6.1: Support for / opposition to shale gas development

Considering everything, do you support or oppose shale gas development in the following areas? Check one per row.

	Strongly Oppose	Oppose	Slightly Oppose	Slightly Support	Support	Strongly Support	**Mean**
In your community	28.4	9.6	7.5	10.8	21.1	22.7	**3.55** **NY – 2.99*** **PA – 4.16***
In your state	23.6	9.7	7.6	11.3	24.0	23.9	**3.74** **NY – 3.20*** **PA – 4.34***
In the USA	18.8	7.5	9.7	12.6	23.8	27.5	**3.98** **NY – 3.46*** **PA – 4.54***

Note: All numbers in this table (and all other tables in this section) represent the percentage of responses to each variable in each category. The final column in each table presents the mean (average) value for each variable. The scale for the mean is based on the number of response options for that particular variable, as indicated in each table.

Significance of two-tailed independent samples t-test: * $p < 0.001$, † $p < 0.01$, ‡ $p < 0.05$.

Table 6.2 reports perceived likelihood of impacts occurring and perceived effect of impacts on quality of life if they were to occur. The effects of development rated most likely were (in order): increased traffic, increased rental housing prices, short-term local economic growth, worse road quality, decreased peace and quiet, and changes in community character. Each of these effects had an average response between "likely" and "very likely". The effects rated least likely were (in order): lower taxes locally, less tourism locally, decreased greenhouse gas (carbon) emissions, lowered property values, and decreased personal/family health. Each of these effects had an average response below the mid-point of 2.5 on the 1-4 scale measuring likelihood.

The effects rated as having the largest effect on quality of life, if they were to occur, were (in order): increased traffic, worse road quality, decreased water quality, and decreased peace and quiet. Each of these effects had an average response between "some effect" and "a large effect" on quality of life. The effects rated as having the smallest effect on quality of life, if they were to occur, were (in order): less tourism locally, personal income from leasing / royalties on gas, and increased rental housing prices. Each of these effects had an average response below the mid-point of 2.5 on the 1-4 scale measuring effect on quality of life.

Table 6.2: Beliefs about impacts of shale gas development

We're interested in your thoughts on impacts of shale gas development. Check two boxes in each row, one for each question.

	How *likely* do you think the following effects of shale gas development are?					**If it were to occur, how much of an effect would each outcome have on your *quality of life*?**				
	Not at all likely	Not very likely	Likely	Very likely	**Mean**	No effect at all	Little effect	Some effect	A large effect	**Mean**
Increased traffic	1	5	29	64	**3.56**	5	14	32	49	**3.25**
Increased rental housing prices	3	10	33	54	**3.38**	33	22	22	23	**2.36**
Short-term local economic growth	3	12	47	39	**3.21**	12	28	40	20	**2.67**
Worse road quality	9	20	23	48	**3.10**	8	18	29	45	**3.11**
Decreased peace & quiet	6	23	33	38	**3.03**	8	21	31	40	**3.04**
Changes in community character	6	24	34	37	**3.02**	9	27	32	32	**2.87**
Increased industrialization	6	23	42	29	**2.94**	10	24	39	27	**2.83**
Increased jobs for locals / our children	8	25	33	33	**2.91**	16	28	33	23	**2.63**
Decreased water quality	12	29	21	39	**2.87**	11	22	18	49	**3.05**
Decreased local beauty	12	27	24	37	**2.87**	11	25	26	38	**2.90**
Decreased fish & wildlife health	14	28	21	37	**2.80**	14	23	23	40	**2.88**
Increased crime	13	33	27	27	**2.69**	14	27	29	31	**2.76**
Increased energy independence	15	30	29	26	**2.66**	16	27	33	25	**2.66**
Decreased quality of outdoor recreation	18	31	20	32	**2.65**	17	25	24	34	**2.74**
Increased stress	16	30	28	26	**2.65**	18	25	29	28	**2.67**
Personal income from leasing / royalties on gas	24	17	31	29	**2.65**	35	18	23	23	**2.34**

	Not at all likely	Not very likely	Likely	Very likely	**Mean**	No effect at all	Very little effect	Some effect	A large effect	**Mean**
Decreased air quality	17	33	21	29	**2.62**	15	25	24	36	**2.81**
Long-term local economic growth	16	31	28	25	**2.61**	16	27	34	23	**2.64**
Preservation of agricultural land	19	31	26	24	**2.55**	12	24	33	32	**2.84**
Decreased personal / family health	20	36	22	22	**2.47**	20	27	23	30	**2.62**
Lowered property values	21	36	22	21	**2.43**	17	26	28	29	**2.69**
Decreased greenhouse gas (carbon) emissions	23	37	26	15	**2.33**	13	29	33	25	**2.69**
Less tourism locally	21	42	22	16	**2.32**	33	36	20	12	**2.11**
Lower taxes locally	27	47	18	8	**2.07**	14	30	34	22	**2.64**

The question about ethical rationales for regulating development reveals, first and foremost, that respondents identified all of the ethical considerations as important for decision making on shale gas development (Table 6.3). The responses were heavily skewed toward "very" and "extremely important". The lowest mean on this six-point scale was 4.70 (between "important" and "very important"). Differences between importance of the ethical norms were minor, but substantial differences did emerge in response to the question of which norms were *most* important. When asked to indicate which two norms were most important, the clear front-runners were: "rights to clean air and water" (51%), preventing harm *at all costs* (emphasis original) (38%), and people's rights to use their property as they want to (32%). (Note: the total percentage in this column of Table 6.3 adds up to 200% because respondents were asked to select two most important items.)

Table 6.3: Ethical rationales for regulating shale gas development

Please let us know how important you believe each of the following should be for decision making on shale gas development (center). Then mark the *two* you think should be *most* important for decision making (at right).

	Not at all important	Not very important	Moderately important	Important	Very important	Extremely important	% that selected this option as one of the two most important	**Mean**
Rights to clean air and water	1	1	3	16	21	59	51	**5.33**
A fair and transparent process	1	1	3	22	28	46	18	**5.13**
Weighing all risks and benefits	1	1	5	22	29	43	20	**5.05**
Citizens having a say in decision-making	1	1	7	22	28	40	14	**4.96**
Using caution in light of uncertainty	1	3	6	25	27	38	12	**4.88**
Preserving the way of life in my community	1	3	9	25	26	37	11	**4.83**
People's rights to use their property as they want to	3	4	8	21	21	43	32	**4.83**
Preventing harm *at all costs*	3	3	7	24	24	39	38	**4.81**
Distribution of risks & benefits (*who* benefits, *who* is harmed)	3	4	8	25	27	34	6	**4.70**

B. Community history and community characteristics

Most of the survey respondents believe they live in a rural area with a healthy and unique natural environment (see the first four questions in Table 6.4). Like the responses to the question about ethical norms, these answers are heavily skewed to the 4-6 response options on the 1-6 scale. The next four questions in Table 6.4 approach more closely a normal distribution. These questions measure economic and social stability and resilience.

Table 6.4: Perceptions of community characteristics

To what extent do the following characteristics describe your community? Please check one per row.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree	**Mean**
Rural way of life	2	2	3	11	42	41	**5.11**
Unique natural environment	1	4	4	17	43	31	**4.89**
Healthy environment	2	1	3	12	50	32	**5.04**
High quality water resources	2	3	4	12	42	37	**5.00**
Economic stability	7	14	20	32	21	7	**3.64**
People share the same values	5	11	15	32	29	8	**3.91**
Residents can work together to resolve issues	4	7	15	37	30	7	**4.03**
This community can adapt to change	4	8	16	35	31	6	**3.98**

Overall, respondents live in areas that have very little experience with oil drilling, coal mining, and other forms of mining (see Table 6.5). These areas, however, have a history of natural gas drilling, and to an even greater extent, timber harvesting. Of those individuals who have experienced natural gas drilling, there is a fairly normal distribution in terms of how positive or negative that experience has been. The mean for this variable is slightly on the positive side of the scale mid-point. Experience with timber harvesting is clearly the most positive of any historical experience respondents had with extractive industries.

Table 6.5: History of resource development in the area

We want to understand the history of natural resource use in your area. Check two boxes in each row, one for each question.

	How much experience has the area you live in had with the following:				**If your area has experience, how positive or negative has this experience been?**				
	None or very little	Some	A great deal	**Mean**	Very negative	Somewhat negative	Somewhat positive	Very positive	**Mean**
Natural gas drilling	36	31	34	**1.98** **NY – 1.51*** **PA – 2.49***	16	28	36	21	**2.62** **NY – 2.48*** **PA – 2.71***
Oil drilling	89	9	2	**1.12** **NY – 1.09†** **PA – 1.16†**	24	33	34	9	**2.28** **NY- 2.17‡** **PA – 2.36‡**
Coal mining	82	13	5	**1.23** **NY – 1.03*** **PA – 1.46***	25	36	31	9	**2.23** **NY – 2.02†** **PA – 2.33†**
Other mining	74	16	9	**1.35** **NY – 1.36** **PA – 1.34**	17	30	38	16	**2.53** **NY – 2.61** **PA – 2.45**
Timber harvesting	10	42	48	**2.39** **NY – 2.32*** **PA – 2.46***	3	16	52	30	**3.08** **NY – 3.12** **PA – 3.04**

Significance of two-tailed independent samples t-test: * $p < 0.001$, † $p < 0.01$, ‡ $p < 0.05$.

Note: Sample sizes for the second question were smaller than for the first question, presumably due to people who had not experienced natural resource extraction not answering the second question. Sample sizes were: 889 (natural gas drilling), 385 (oil drilling), 433 (coal mining), 502 (other mining), 1039 (timber harvesting).

The question of whether the community is better or worse off than it was five years ago received responses that approximate a normal distribution (Table 6.6). The interviews analyzed in Chapter Five revealed that whether people liked their community "as is", or thought the community needed to change (often to return to a previous, better state) could potentially affect views of and beliefs about shale gas development.

Table 6.6: Status of community: improving or declining

Considering everything, do you think your community is better or worse off than it was five years ago? Please circle one.

Much better off	Better off	About the same	Worse off	Much worse off	**Mean**
8%	19%	42%	25%	7%	**2.97** **NY – 2.70*** **PA – 3.29***

Significance of two-tailed independent samples t-test: * $p < 0.001$, † $p < 0.01$, ‡ $p < 0.05$.

C. Personal beliefs and values

The vast majority of respondents agreed with most of the statements from my questions about the respondents' connection to their local community (Table 6.7). The only statement to not exhibit substantial agreement was, "My community is special to me as it is; I would not want anything to change." As mentioned previously, the reticence or desire to see one's community change played a large role in shaping representations of shale gas development in the interviews.

Table 6.7: Connection to the local community

Please let us know whether you agree or disagree with the following statements about your community.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree	**Mean**
I care deeply about protecting and improving my community.	0	1	1	18	46	34	**5.11**
The land has its own value, independent of what it provides for us humans.	2	3	5	14	36	39	**4.97**
The land in my community is important because it provides for our people.	1	4	5	19	42	30	**4.84**
I feel close to people outside my community who share my values.	2	5	9	33	43	8	**4.36**
I feel close to people who live in my community.	3	9	9	33	37	9	**4.18**

My community is special to me as it is; I would not want anything to change.	8	16	20	22	21	13	**3.71**

I included the fourth and fifth sub-questions in Table 6.7 to reveal whether people had greater proclivity to connect with people in their community or outside of it (i.e., to affiliate with communities of place or communities of interest). Both affiliations seemed important for the majority of survey respondents. I included the second and third sub-questions in Table 6.7 to explore whether respondents would be more likely to value land for anthropocentric or ecocentric reasons. The vast majority of respondents found the land to be important for both sets of reasons. Finally, it is notable that 98% of my respondents agreed with the statement, "I care deeply about protecting and improving my community." While this is not surprising, the data from the survey parallels closely what I heard my interviewees articulate about themselves, and it is the complete opposite of what many interviewees asserted about other members of their community (see the "self-interest [greed] vs. community-mindedness representation in Chapter Five).

Overall, respondents believe sustainability and resilience are important for the future of their communities (Table 6.8). I selected the wording for the sub-questions in Table 6.8 based on a reading of academic literature on sustainability and resilience (see Chapter Three). All measures of sustainability display higher means than each measure of resilience. Additionally, a higher percentage of individuals considered each of the measures of sustainability to be "extremely important", compared to each of the measures of resilience.

Table 6.8: Importance of sustainability and resilience to community future

How important do you think the following are to a positive future for communities like yours? Please check one per row.

	Not at all important	Not very important	Moderately important	Important	Very important	Extremely important	**Mean**
Being a community that can "reinvent" itself	3	7	16	38	22	14	**4.12**
Integrating economic, environmental, and social issues in decision making	1	2	9	36	30	22	**4.58**
Being able to absorb and adapt to change	1	2	12	40	28	17	**4.43**
Considering future consequences of decisions	0	0	4	25	29	41	**5.05**
Having a diverse economy	1	2	12	38	28	19	**4.45**
Understanding "tipping points" in how much stress the local environment can handle	1	2	7	29	24	37	**4.85**

The survey respondents strongly agreed with the importance of private property rights and with the delicate balance of nature (Table 6.9). Respondents tended to disagree that the economic market should govern development. I discuss these questions in more detail later in this chapter due to their importance as factors affecting SR of shale gas development.

Table 6.9: Broad policy views affecting resource management

Please let us know whether you agree or disagree with the following statements. Check one per row.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree	**Mean**
A first consideration of a good political system is protection of private property rights.	3	5	6	14	35	38	**4.88** **NY – 4.72*** **PA – 5.07***

The balance of nature is very delicate and easily upset by human activities.	2	4	5	15	28	46	**5.03 NY – 5.05 PA – 5.00**
Decisions about development are best left to the economic market.	30	29	15	15	9	3	**2.52 NY – 2.42† PA – 2.64†**

Significance of two-tailed independent samples t-test: * $p < 0.001$, † $p < 0.01$, ‡ $p < 0.05$.

D. Fora for emergence of social representations on shale gas development

A few of my questions in the survey specifically solicited information on how respondents developed their representations of shale gas development. My question about the extent to which people form views on shale gas development after discussing the topic with their community revealed a fairly normal distribution, slightly skewed to agreement (Table 6.10). I included this question as one measure of the extent to which people form representations *socially* – after engaging in social interaction. Respondents were much more likely to assert that they search out information on shale gas development on their own. This is, of course, not in exclusion to the previous question. Many of my interviewees sought out information on shale gas development independently, which they then shared with others in their community, teaching and learning in turn from other community members. Overall, survey respondents widely agreed they were well informed about shale gas development. The level of agreement with the second and fourth questions in Table 6.10 supports the "misinformation about misinformation" representation that emerged in my interviews. A sizable majority of respondents believe that people on their side of the issue use facts to support their positions and that people on the other side of the issue are misinformed.

Table 6.10: Knowledge of shale gas development

Please indicate whether you agree or disagree with the following statements about *shale gas development*.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree	**Mean**
I search out information on this topic on my own.	3	5	5	19	42	27	**4.73**
People who feel as I do about this topic often support their views with facts.	3	4	9	25	39	21	**4.56**
I consider myself well informed on the topic of shale gas development.	5	7	12	28	31	17	**4.26**
People opposed to my views on this issue are often misinformed.	4	9	18	27	25	17	**4.11**
I formed my views on shale gas development after discussing it with people in my community.	9	19	13	28	25	7	**3.60**

Table 6.11 speaks directly to the ways in which survey respondents obtained their information about shale gas development. The most common means by which respondents became familiarized with shale gas development were (in order): local newspapers, friends and family, other people in the community, and television. Each of these sources had an average response between "occasionally" and "often" for frequency of use. The response category of "casual conversations" also averaged between occasionally and often. "Casual conversations" could be with friends, family, or other community members, but I included this additional response category due to the importance in the interviews of non-formal avenues for discourse as an important social form of information exchange. Social media and cooperative extension were clearly the least used sources for learning about shale gas development. The three most used sources are all major forms of social discourse that occur at the community level – this provides some indication that much information gained on shale gas development is transmitted via the hypothesized information sharing pathways in SR theory.

Table 6.11: Sources for information on shale gas development

How have you heard or read about *shale gas development*? Please check two boxes in each row, one for each question.

	How often have you read or heard about this issue from each source?				**If you've used it, how helpful has each source been for understanding the issue?**				
	Never	Occasionally	Often	**Mean**	Not helpful	Somewhat helpful	Very helpful	**Mean**	**N**
Local newspaper	4	37	59	**2.55**	14	68	18	**2.03**	1001
Family and friends	5	48	47	**2.41**	13	61	26	**2.13**	981
Other people in your community	6	55	39	**2.34**	12	64	24	**2.12**	571
Television	10	53	37	**2.26**	24	63	13	**1.89**	952
Casual conversations (ex., at the diner, etc.)	14	58	29	**2.15**	18	66	16	**1.98**	952
Environmental groups	28	46	27	**1.99**	23	61	26	**2.03**	908
National newspaper	27	49	24	**1.97**	20	62	18	**1.98**	879
Internet	34	37	29	**1.95**	10	49	41	**2.31**	861
Radio	29	47	23	**1.94**	23	62	15	**1.91**	899
Industry	36	46	18	**1.81**	28	59	13	**1.84**	869
Public meetings	37	48	14	**1.77**	11	65	24	**2.13**	860
NY DEC / PA DEP	42	47	11	**1.69**	21	66	14	**1.93**	835
University scientists	47	41	12	**1.65**	12	58	30	**2.18**	848
Cooperative Extension	60	33	7	**1.48**	9	67	24	**2.15**	443
Social media (ex. Facebook, Twitter)	68	20	11	**1.43**	33	51	17	**1.84**	779

Note: Sample sizes for the second question were smaller than for the first question, due to the requirement that the first question be answered "occasionally" or "often" for the second question to be answered at all. The final column provides the sample size for each row in the second column.

The second half of Table 6.11 details the importance of each information source for respondents who consulted those sources at least occasionally. The wording of the question asked for responses only "if you've used it" for each source; yet, several people who selected "never" in the first half of the question still provided answers for the second half. I excluded all

such responses from the data presented in Table 6.11. Including those responses would have lowered the average value for each question, and would have lowered some average values substantially (particularly for those questions that had a large percentage of "never" responses in the first half of the question). For people who used the information source in question, the most useful sources were (in order): Internet, university scientists, cooperative extension, public meetings, family and friends, and other people in the community. The least useful sources were: industry, social media, television, and radio. The variation in usefulness of the fifteen sources was less than the variation in the frequency of use. For each source, save Internet, the majority of respondents who used that source indicated that they found the source "somewhat helpful" (the scale midpoint).

E. Structural factors

The penultimate section of my survey included a few questions about respondents' structural connections to the physical landscape that my newspaper content analysis and interviews suggested could predict SR of shale gas development. Thirty-six percent of respondents reported having leased their mineral rights for oil or gas extraction; of this group, 88% reported owning that lease. I also asked these respondents to indicate the year in which their lease was signed; responses ranged from 1987-2013, with 84.3% occurring in 2006 or later. This was the first year in which substantial leasing for shale gas development in the Marcellus Shale occurred. Therefore, while some oil and gas development has occurred historically in southern NY and northern PA, the vast majority of respondents with leased property had leases related to shale gas development. I found the percentage of respondents with leased land surprisingly high (36.4%), but I intentionally mailed the survey to residents in several communities with high levels of development or potential for development.

Almost three-fourths of the respondents (73.3%) obtain their drinking water from a private well. Multiple interviewees and several newspaper articles indicated that having well water (or town water, but from a groundwater aquifer) could affect representations of shale gas

development. Ninety percent of respondents rely on groundwater (from a well, or town/city water piped from an aquifer); this lack of variation indicates that this variable is of little use in multivariate statistical tests.

F. Demographic variables

The survey ended with demographic questions. Of the respondents, 55.5% were male and 44.5% were female. The median respondent was 60 years old (mean = 59, mode = 61). For educational attainment, I measured five levels of education. I list the percentage of respondents at each level: didn't graduate high school (3%), high school graduate / GED (27%), some college (29%), completed 4-year degree (21%), and completed graduate degree (20%). Finally, to measure political views I included the question in Table 6.12. The distribution of political views was fairly normal with the sample slightly more conservative than liberal overall.

Table 6.12: Political views

How would you describe your political views? Circle one.

Very Liberal	1 7%	2 8%	3 11%	4 23%	5 19%	6 15%	7 17%	Very Conservative	**Mean** **4.52** **NY – 4.31*** **PA – 4.75***

Significance of two-tailed independent samples t-test: * $p < 0.001$, † $p < 0.01$, ‡ $p < 0.05$.

III. Non-respondent Follow-up

I finished collecting the 1202 responses to my mailed survey in November 2013. I contracted with Cornell University's Survey Research Institute (SRI) to implement a telephone follow-up survey with a random sample of non-respondents in December 2013. I trained individuals who called this random sample, asking 29 questions (compared with the 168

questions I asked in the mailed survey). SRI completed this abridged survey with 75 respondents from NY and 75 from PA. Only three NY residents and four PA residents refused to participate in the telephone survey. Over 1,100 residents were called, but no live person answered the phone.

The follow-up survey included a sampling of: (1) measures of SR of shale gas development, (2) sources of information about development, (3) demographic variables, and (4) level of exposure to and engagement with the issue of shale gas development. I report frequencies and means below for the non-respondent survey, comparing answers with those from the mailed survey.

A. SR of shale gas development

Three questions from the non-respondent survey appear in Table 6.13. Substantial differences emerged between the mailed survey and the follow-up.

Table 6.13: Support / opposition for shale gas development, non-respondents

Considering everything, do you support or oppose shale gas development in the following areas? Check one per row.

	Strongly Oppose	Oppose	Slightly Oppose	Slightly Support	Support	Strongly Support	**Mean**
In your community	22	6	7	10	24	31	**4.02**
In your state	17	9	5	11	26	32	**4.16**
In the USA	11	12	6	10	22	40	**4.40**

Although the bimodal character to the responses was retained in the non-respondent follow-up, this sample exhibited higher levels of support for shale gas development compared to the individuals who responded to the original, mailed survey. The average support for development (on a six-point scale) was 0.47 higher for development in the community (3.55 vs. 4.02), 0.42 higher for development in the state (3.74 vs. 4.16), and 0.42 higher for development

in the USA (3.98 vs. 4.40), compared with the original survey. For each of these three questions, a majority of respondents supported or strongly supported shale gas development (5 or 6 on the six-point scale).

The other SR of shale gas development measured in the follow-up survey were eight variables from the question about perceived likelihood of effects associated with development. Non-respondents thought all impacts were less likely to occur (see Table 6.14). The difference between the mean response from the original and non-respondent surveys was less, however, for (positive) economic effects than for (negative) social and environmental effects. The difference between the means in the two surveys was largest for decreased air quality and decreased water quality.

Table 6.14: Beliefs about impacts of shale gas development, non-respondents

How *likely* do you think the following effects of shale gas development are?

	Not at all likely	Not very likely	Likely	Very likely	**Mean**	**Mean from original**
Increased traffic	7	15	22	57	**3.29**	**3.56**
Short-term local economic growth	9	15	31	45	**3.11**	**3.21**
Long-term local economic growth	21	29	28	23	**2.53**	**2.61**
Personal income from leasing / royalties on gas	34	15	22	29	**2.45**	**2.65**
Increased stress	29	25	20	26	**2.43**	**2.65**
Decreased water quality	32	24	20	25	**2.37**	**2.87**
Decreased air quality	41	22	17	21	**2.17**	**2.62**
Decreased quality of outdoor recreation	42	21	15	22	**2.17**	**2.65**

B. Sources of information about shale gas development

Of the fifteen potential sources of information about shale gas development included in the original survey, I queried non-respondents about their use of five of them in the follow-up

survey. In each instance, the non-respondents received information from these sources less frequently than respondents did. There were, however, no major differences in the relative importance of information sources within the samples of respondents. Like respondents, non-respondents obtained information on shale gas development most commonly from family and friends and local newspapers.

Table 6.15: Sources of information, non-respondents

On the issue of *shale gas development*, how often have you read or heard from each of the following sources?

	Never	Occasionally	Often	**Mean**	**Mean from original survey**
Family and friends	16	44	40	**2.24**	**2.41**
Local newspaper	23	35	42	**2.19**	**2.55**
Television	27	43	29	**2.02**	**2.26**
Internet	52	28	20	**1.68**	**1.95**
National newspaper	63	23	13	**1.50**	**1.97**

C. Exposure to and engagement with shale gas development

In each table below, I present first the data from the original survey and then from the follow-up telephone survey. Table 6.16 highlights that respondents reported much higher levels of active involvement in local issues in their communities (in general), compared to non-respondents. Tables 6.17-6.19 address level of engagement with the topic of shale gas development specifically.

Table 6.16: Involvement in local community issues, respondent and non-respondent

Please describe your level of involvement in local issues within your community, in general. Circle one.

	Not active at all	Not very active	Somewhat active	Very active	**Mean**
Original survey data	15	35	44	7	**1.74**
Non-respondent follow-up	39	36	18	7	**2.27**

A far smaller percentage of non-respondents were aware of meetings or rallies held in their communities compared with respondents (Table 6.17). Respondents also displayed a much greater propensity to engage in actions related to spreading the word on, or communicating a specific message about, shale gas development, compared to non-respondents (Table 6.18).

Table 6.17: Awareness of community events *about shale gas development*

Are you aware of any meetings or rallies on shale gas development that have been held in your community? Please circle one.

	No, none	Yes, at least one	Yes, several	**Mean**
Original survey data	20	30	51	**1.74**
Non-respondent follow-up	58	21	21	**2.27**

Table 6.18: Engagement with shale gas development

How often have you engaged in the following actions, with a specific focus on shale gas development? [Original survey data]

	Never	Once	More than once	**Mean**
Shared information with community members	29	14	57	**2.27**
Attended a meeting or rally	53	21	27	**1.74**
Signed a petition	57	19	24	**1.67**

[Non-respondent follow-up data]

	Never	Once	More than once	**Mean**
Shared information with community members	61	11	28	**1.67**
Attended a meeting or rally	71	13	16	**1.45**
Signed a petition	77	13	11	**1.34**

Respondents reported seeing and hearing signs of development more often, compared to non-respondents (Table 6.19). It is notable, however, that the difference between respondents and non-respondents in Table 6.19 is smaller than the differences between these groups exhibited in Tables 6.17 and 6.18. Therefore, while non-respondents were clearly less aware of, less engaged in, and less observant of shale gas development, the extent to which they were less observant is smaller compared to the extent to which they were less engaged (i.e., the differences in means between respondents and non-respondents in Table 6.19 are smaller than in Tables 6.17 and 6.18). This provides some indication that it is likely not only for structural reasons (e.g., fewer opportunities to become active on the issue) that the non-respondents engaged less with shale gas development issues. The data on community involvement in general, in Table 6.16, support this conclusion.

Table 6.19: Experience with and exposure to shale gas development

How commonly do you see or hear the following, *associated with shale gas development* in your area? [Original survey data]

	Never	Occasionally	Frequently	**Mean**
Signs supporting or opposing gas drilling	14	38	49	**2.35**
Noise related to industry or traffic	24	35	41	**2.17**
Increased local economic activity	28	35	37	**2.09**

[Non-respondent follow-up data]

	Never	Occasionally	Frequently	**Mean**
Signs supporting or opposing gas drilling	33	27	40	**2.07**
Noise related to industry or traffic	44	21	35	**1.91**
Increased local economic activity	39	23	38	**1.99**

D. Demographic and social structural data

I included four of the demographic questions and one social structure question from the original survey on the non-respondent follow-up survey. In the non-respondent sample, 31% had leases and 69% did not. This compares closely with the 36% and 63% from the respondents to the original survey. The four demographic questions were: sex, age, education level, and political views.

In the non-respondent follow-up, the sample was 40.7% male and 59.3% female. This differs noticeably from the 55.5% male and 44.5% female original survey sample. Some of this difference may be due to variation in who, within a household, is likely to fill out a mailed survey versus who is more likely to answer the telephone. The 2008-2012 American Community Survey five-year estimates from the US Census Bureau indicate that the percent of males in the population from the ten counties included in my survey ranges from 48.8% to 52.6%, with a median of 49.3%.

The median non-respondent was 56 years old (mean = 56, mode = 49); this compares closely with the median age of 60 years from the original sample. The Census statistics for the ten counties included in my survey reveal a median age in the counties from 29.8 - 45.6 years, with the median of these medians at 42.0 years. While the age of the respondents to the original and follow-up surveys is much higher the median in the general population, it is worth noting that only residents at least the age of 18 were eligible to participate in the survey. The median age in NY of residents 18 years or older is between 45-49 years (according the US Census). The median age of PA residents at least 18 years old is between 50-54 years.

Non-respondents reported having less formal education than respondents. For each of the following levels, I compare the percentage from my respondents and non-respondents respectively: didn't graduate high school (3%, 3%), high school graduate / GED (27%, 29%), some college (29%, 40%), completed 4-year degree (21%, 13%), and completed graduate degree (20%, 15%). Combining the last two categories, 41% of the respondents to the original survey and 29% of the respondents to the follow-up survey completed at least a 4-year degree. This US Census rate for completion of 4-year degrees within the ten counties for the survey ranged from 16.1% to 49.9%, with a median of 19.7%. There were notable differences in the US Census statistics between the NY and PA counties, with a median rate in NY of 23.6% and a median rate in PA of 16.3%. Finally, political views did not differ strongly between respondents and non-respondents (Table 6.20).

Table 6.20: Political views, respondents and non-respondents

	Very Liberal 1	2	3	4	5	6	Very Conservative 7	**Mean**	**Mean from original**
Non-respondent follow-up	12	4	12	24	11	10	27	**4.58**	**4.52**

E. Implications of non-respondent survey for data analysis and interpretation

Notable differences exist between survey respondents and non-respondents. Non-respondents are more supportive of shale gas development, less likely to think that impacts will occur (particularly environmental and social impacts), and less likely to have read or heard about development. Additionally, they are less aware of discourse on development in their communities, observe fewer signs of development, are less engaged in issues surrounding development, and are less active on community issues generally. Respondents are slightly older, more likely to be male, more educated, and have similar political views, compared with non-respondents.

These differences can be interpreted in many ways. A pro-development individual would presumably point out that support for shale gas development in the survey communities is likely greater than the original survey reveals because a greater percentage of non-respondents selected "support" or "strongly support". These individuals would also note that, except for increased traffic, non-respondents considered all the (negative) environmental and social impacts less likely to occur than all of the (positive) economic impacts.

An anti-development individual would likely be equally quick to highlight that respondents to the original survey are much more aware of shale gas development, discourse about development, and its effects. These are the people who know about and attend meetings – who talk about and share information on development with local residents. The anti-development individual would note that the people who are likely better informed about development are the ones who support it less.

A more nuanced way of interpreting the findings reflects comments I heard in some interviewees and informal conversations in my study communities. One could interpret the difference between the survey results as evidence that the general public, in contrast to people heavily engaged in the issue, see some good and some bad coming from development, they think potential effects are likely overstated to some degree, but they are just ready to get on with development. In this sense, the strong support for shale gas development in the non-respondent follow-up survey could be more of an acknowledgement that shale gas development is going to occur and a willingness to move forward than the unmitigated enthusiasm or dismay seen in the responses to the original survey. In a sense, the original survey respondents, with their more substantial engagement in the issue, might represent a larger sample of the type of interviewees with whom I spoke. The non-respondents could parallel the people with whom I had casual conversations in my study communities.

The question remains: based on the differences between the survey responses, and between the surveys and the population statistics, should I make any transformations to the data before conducting further analysis? I decided to weight the data to account for population values

and to compare these results with the results of non-weighted data. For the population values, I used the 2012 American Community Survey 5-year estimates from the US Census Bureau for age, sex, and education. These three variables correlated with support/opposition for shale gas development and other representations (discussed more in the sections below). I created two categories for each variable in each state: sex (male, female), age (18-44, 45 and over), education (less than bachelor's degree, bachelor's degree or greater). This produced 16 weights to apply to the respondents (Table 6.21). Weights ranged from 0.30-4.16. For NY population values, I averaged the population across the six counties included in my survey (Broome, Chemung, Cortland, Delaware, Tioga, and Tompkins); for PA values, I averaged the population across the four counties in my survey (Bradford, Lycoming, Susquehanna, and Wayne).

Table 6.21: Proportional weights for survey data

NY

	Population %	Respondent %	Weight
Male, 18-44, less than bachelors	0.185	0.052	3.56
Male, 18-44, bachelors+	0.053	0.046	1.15
Male, 45+, less than bachelors	0.182	0.23	0.79
Male, 45+, bachelors+	0.068	0.203	0.33
Female, 18-44, less than bachelors	0.17	0.046	3.70
Female, 18-44, bachelors+	0.06	0.04	1.50
Female, 45+, less than bachelors	0.214	0.203	1.05
Female, 45+, bachelors+	0.068	0.179	0.38

PA

	Population %	Respondent %	Weight
Male, 18-44, less than bachelors	0.178	0.051	3.49
Male, 18-44, bachelors+	0.028	0.026	1.08
Male, 45+, less than bachelors	0.238	0.329	0.72
Male, 45+, bachelors+	0.051	0.172	0.30
Female, 18-44, less than bachelors	0.154	0.037	4.16
Female, 18-44, bachelors+	0.039	0.019	2.05
Female, 45+, less than bachelors	0.264	0.24	1.10
Female, 45+, bachelors+	0.048	0.125	0.38

After weighting the data, I compared the results of the weighted data with the results of the non-weighted data to determine the degree to which the results from the survey respondents could be expected to approximate the general population when accounting for sex, age, and education. The variation in results was minimal for descriptive statistics, a factor analysis, and linear regressions. This indicates that deviation of the survey population from the general population in age, sex, and education did not affect the descriptive or multivariate results. For the sake of clarity and interpretability, I present the *non-weighted* results in the body of this chapter. Appendix H contains the weighted results for: (1) the descriptive statistics for the three sets of social representations, (2) the primary factor analysis reported below, and (3) the two linear regressions reported below.

After using the population-level data to weight my data set, I considered whether to use the non-respondent data to weight my respondent sample. With multivariate statistics, what matters is the relationship between variables. For example, support/opposition had an extremely strong correlation with beliefs about likelihood of impacts. Nevertheless, the extent to which these relationships existed did not vary meaningfully between the two surveys (i.e., regressions between the variables mentioned above showed similar relationships whether they were conducted in the original data set or the non-respondent follow-up data set). For this reason, I did not use the responses to the non-respondent survey to weight the data.

IV. Analysis of Open-ended Data

I included one non-quantitative open-ended question in my survey; it was based on a question Devine-Wright and Howes (2010) used to elicit social representations of place in connection with wind energy development in the UK. I asked respondents to: "Please write, as quickly as you can, any words or phrases that come to mind when you think of 'shale gas development via hydraulic fracturing'". I included two lines and open space for the respondents' answers.

When conducting data entry, the first three distinct thoughts that an individual wrote were entered into the SPSS data file. During analysis, I coded each respondent's statements based on the coding scheme outlined in Appendix I. The most frequently appearing codes were related to impacts (i.e., were environmental, economic, or social impacts mentioned?) and to valenced language (i.e., did words invoke negative, positive, or mixed [positive and negative] sentiments?).

A. Descriptive statistics

The vast majority of open-ended initial representations contained valenced language. Negative language appeared in 45% of representations, positive language in 23%, and mixed language in 13%. These codes were mutually exclusive; therefore, 81% of all responses included some valenced language. The three major categories of impacts were also commonly cited: environmental (39%), economic (27%), and social (22%). While any particular impact was only assigned to one category, a given respondent could mention multiple categories of impacts in his/her full open-ended response.

By far the most frequently-mentioned impact was effects on water; 267 respondents (over 25% of the sample) included "water" or "H2O" in their open-ended text. Other common words used to represent major impacts appear in Table 6.22.

Table 6.22: Most common open-ended representations of impacts

Representation	Number of times mentioned
"water" or "H2O"	267
"job" / "jobs"	96
"traffic"	80
"economic" / "economy"	58
"community" / "communities"	44
"road" / "roads"	40

In many cases, respondents used valenced words to modify specific impacts (e.g., water contamination, water pollution, greatly improved economy, destroyed environment, disaster for the community, good jobs, horrible traffic, good economic growth, etc.). A substantial number of valenced terms were not used in conjunction with impacts, however; they were simply used by themselves as the entire representation. For example the word "bad" was used 51 times (i.e., in a negative way; thus, excluding uses such as "badly needed in our community"); 11 of these times nothing was associated with "bad" – the word appeared by itself. Likewise, the word "good" appeared 43 times (i.e., in a positive way; thus, excluding the 11 references such as "no good"); 23 of those times the word appeared alone. The twenty uses of "good" in which it was attached to impacts include reference to ambiguous impacts like "good for the community". As another example, the words "pollute", "polluted", "pollution", or "polluting" appeared in 92 responses; 36 of these contained only the word.

The tendency for much valenced language to appear by itself, unconnected to any object, indicates the importance of emotions in shaping initial representations of shale gas development. Strongly valenced words that were used appear in Table 6.23.

Table 6.23: Valenced language in open-ended representations

Representation	Number of times mentioned
Negatively-valenced	
"pollute" / "polluted" / "pollution" / "polluting"	92
"contaminate" / "contamination"	57
"bad"	51
"destruction" / "destructive"	31
"poison"	30
"destroy"	29
"ruin"	25
"greed"	22
"disaster"	12
"rape"	9

Positively-valenced	
"good"	43
"help"[1]	26
"improve" / "improvement"	22
"better"[2]	16
"great"	15

[1] "help" excludes 6 negative uses, such as "it will not help"
[2] "better" excludes 7 negative uses, such as "we need something better"

A final frequently-occurring representation, although inconsistently worded, was the belief that shale gas development needs to move forward. This representation came predominantly from NY respondents, who live in an area where shale gas development is effectively prohibited. Comments took the form of phrases such as "What's the hold up?", "Why are we dragging our feet?", "Want fracking", "Should allow", "Opportunity that should not be missed", "Let's do it", "Let's drill", "Get it done already", "It's badly needed", "Bring it on", and "All for it". In opposition to this sentiment, another theme emerged of not wanting shale gas development: "Should not happen", "Let's destroy earth more" (presumably sarcastic), "Leave PA – destroying our environment", and "It's going to be hell on earth for people and animals".

B. Correspondence analyses

In addition to the descriptive analysis of the open-ended questions, I subjected this data to several correspondence analyses, which produce cross-tab chi-square tables that compare two sets of multiple nominal data. These tests also graph the data in a way useful for intuitively understanding the correlation between variables. This analysis technique is a dimension reduction technique that can be interpreted similarly to factor analysis or categorical principal components analysis.

I used the correspondence analyses to examine the connections, within the open-ended responses, between: (1) the major categories of impacts and types of valences, (2) impacts and

support for / opposition to shale gas development, and (3) valences and support/opposition. Although I constructed the response options for the support/opposition variable with equal conceptual distance between each option, which allows for analysis of the variable as continuous data, I treated it as a discrete categorical variable with six values for the purpose of the correspondence analyses.

Figure 6.1 compares respondents' mention (presence/absence) of the three categories of impacts in the open-ended question with their use of valenced language in the three categories. Mention of 'environmental', 'social', and 'environmental and social' impacts is closely associated with negatively valenced language; 'economic' and 'economic and social' impacts are closely associated with positive valenced language. Mention of 'environmental and economic' impacts is closely associated with mixed valenced language. Responses that mention impacts in all three categories are loosely connected to negative and mixed valence language. The inertia of the correspondence analysis in Figure 6.1 is 0.874 (i.e., the amount of variability in each set of variables explained by the other set of variables; technically, the chi-square value divided by the sample size). The chi-square statistic was 475.4, with $p < 0.001$. Of the total inertia, 0.721 (82.5%) is due to dimension 1 (which approximates the extent to which the open-ended comments were positive versus negative).

These relationships are similar to those seen in the correspondence analysis of the newspaper content analysis data in Chapter Four, except that in the newspaper data, the combined categories of impacts were more closely associated with mixed valence. In the survey data, only comments mentioning environmental and economic impacts (but not social impacts) were closely associated with mixed valence. Additionally, dimension 1 in the analysis explained much more of the total inertia than in the newspaper correspondence analysis. In the survey analysis, dimension 1 corresponds roughly to degree of positive versus negative valence.

Figure 6.1: Correspondence analysis, impacts and valences

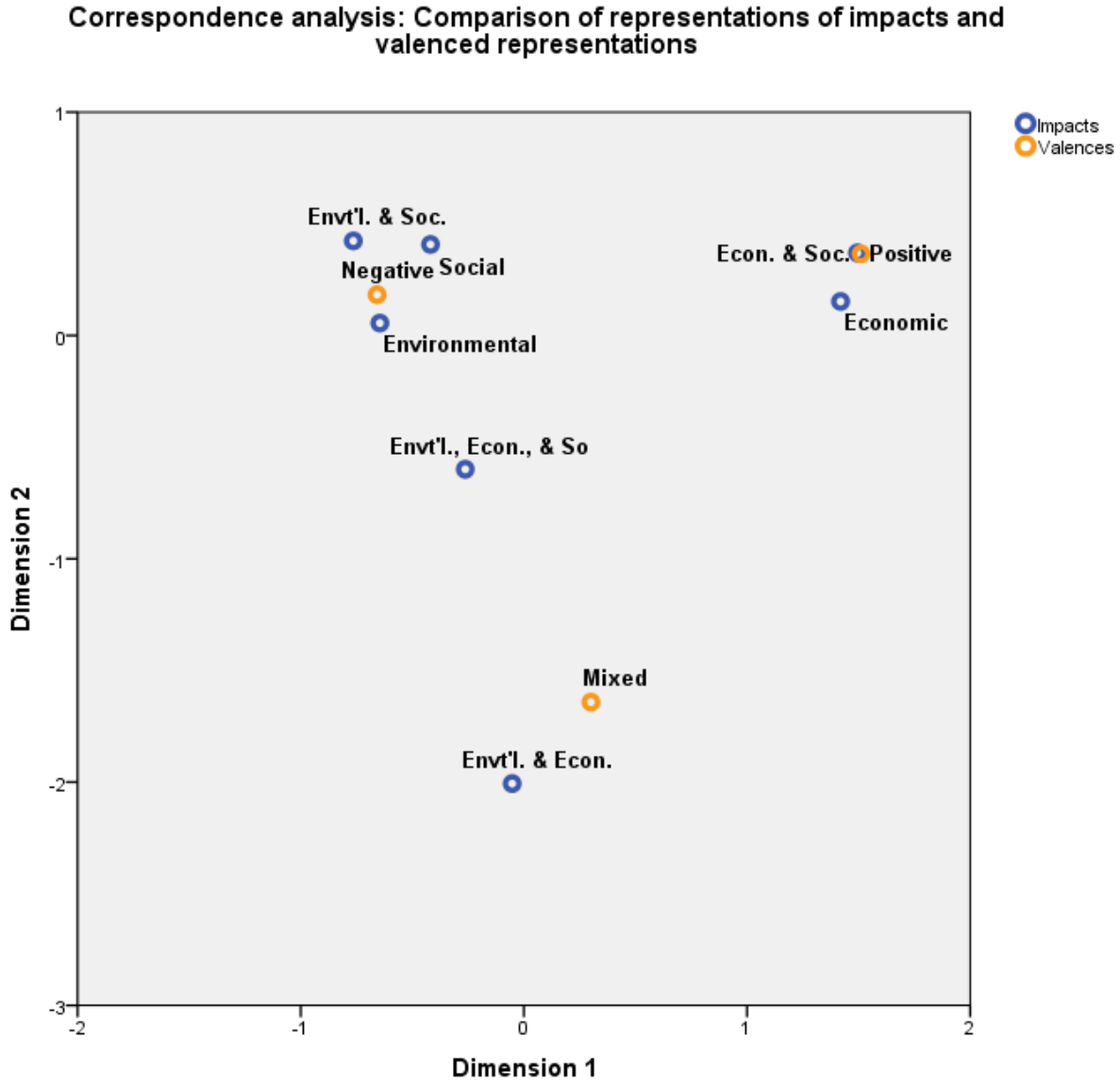


Figure 6.2 compares mention of the three categories of impacts with support for / opposition to shale gas development. References to 'environmental' and 'environmental and social' impacts are closely associated with strong opposition to shale gas development; responses that include economic impacts (alone) are closely associated with strong support. All other combined categories of impacts, and social impacts as its own category, associate more closely with one of the four mid-points on the six-point support/oppose scale. The inertia of the

correspondence analysis in Figure 6.2 is 0.565. The chi-square statistic was 340.6, with $p < 0.001$. Of the total inertia, 0.499 (88.3%) is due to dimension 1 (which approximates the extent of support versus opposition).

Figure 6.2: Correspondence analysis, impacts and support/opposition

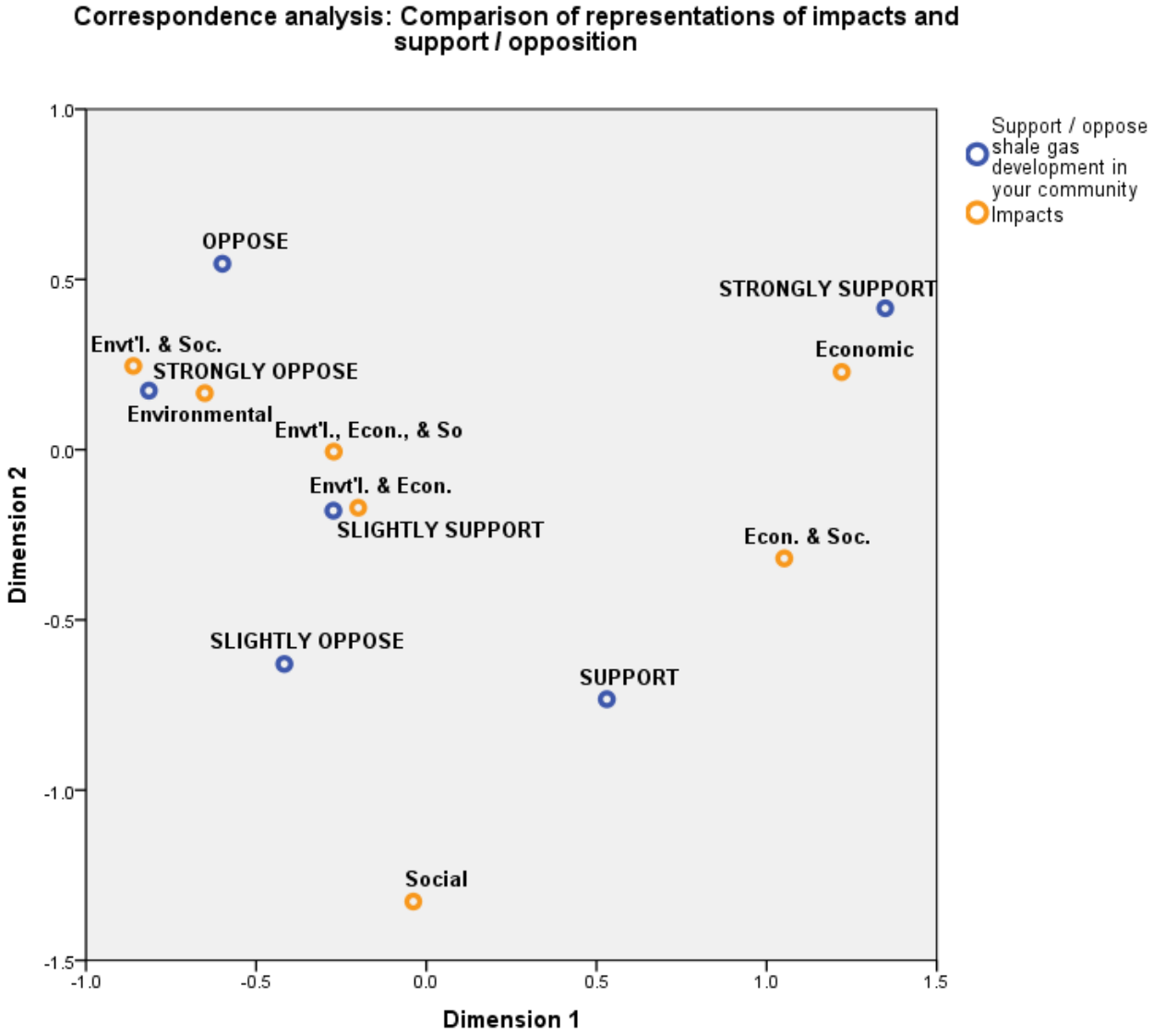
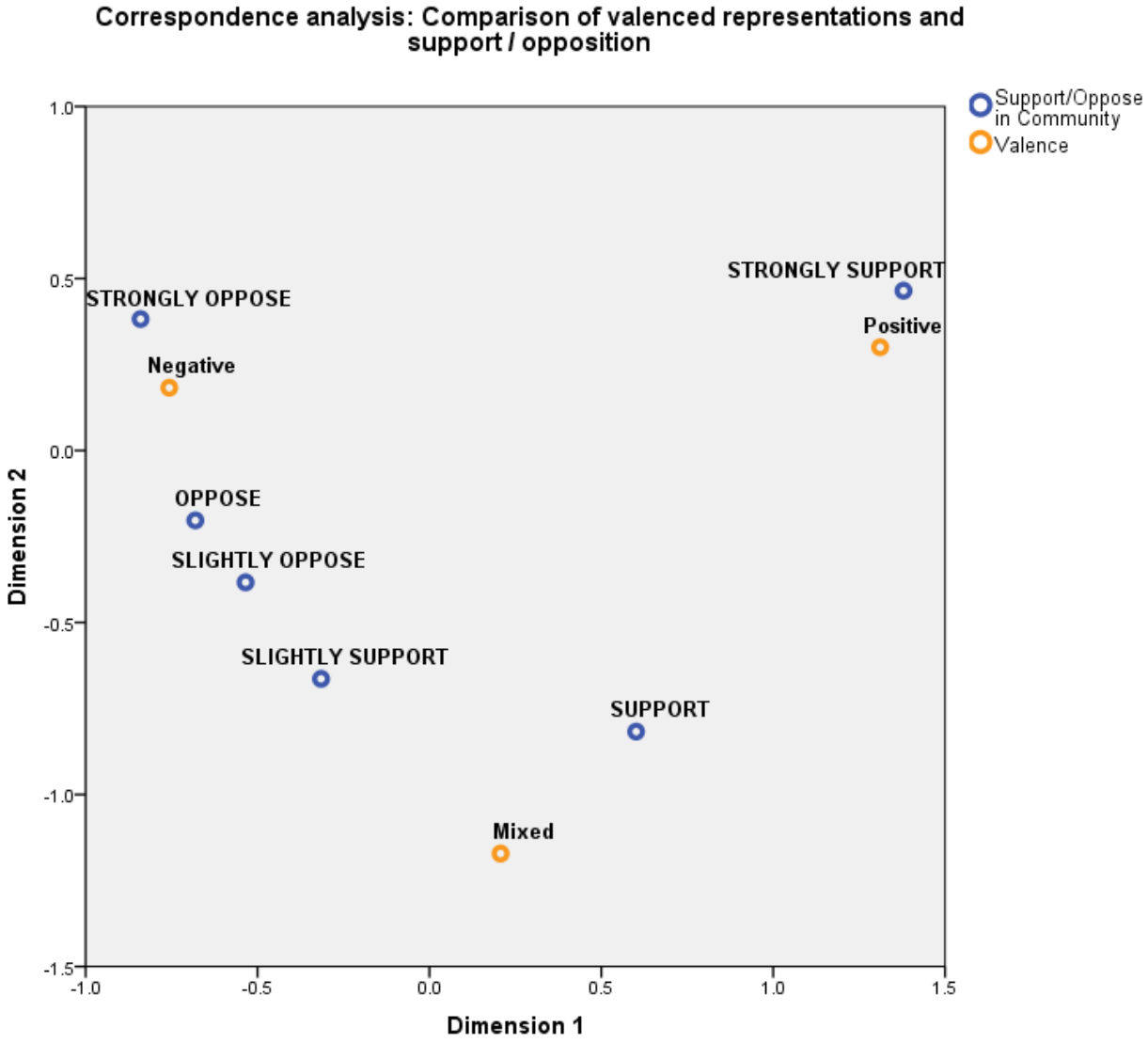


Figure 6.3 compares use of valenced language with support for / opposition to shale gas development. Negative language is closely associated with strong opposition to shale gas development; positive language is closely associated with strong support. Mixed language lies in

between the extremes. The inertia of the correspondence analysis in Figure 6.3 is 0.745. The chi-square statistic is 567.8, with $p < 0.001$. Of the total inertia, 0.675 (90.6%) is due to dimension 1 (which approximates the extent of support versus opposition).

Figure 6.3: Correspondence analysis, valence and support/opposition



Taken together, the correspondence analyses demonstrate that negative wording, environmental impacts, and 'environmental and social' impacts correlate highly with strong opposition, and that positive wording and economic impacts correlate highly with strong support

for shale gas development. While the finding is what one would expect, it has implications for the ways in which one communicates about this issue. Particularly relevant for individuals seeking to introduce nuance into the policy process is the finding that people who mention social issues as their initial representations of shale gas development tend to have far less extreme views when it comes to support/opposition, compared to people who offer environmental or economic representations. This finding holds even though social representations correspond closely with negative language in the open-ended question. I discuss the implication of these correspondence analyses in greater detail in Chapter Seven.

V. Drivers of Social Representations

I analyzed elements affecting representations through a series of factor analyses, linear regressions, and structural equation models. I first conducted factor analyses of the four major representations of shale gas development I measured in the survey (i.e., support/opposition, likelihood of impacts, effect of impacts on quality of life, and ethical considerations for regulation). I based my linear regressions on relationships that social representations theory would hypothesize (e.g., representations are predicted by social structure, historical experience, values, and fora that exist for emergence of SR). I designed my structural equation models by using the factors that emerged from the factor analyses as latent variables and including the strong independent variables from the regressions.

A. Factor analyses

I measured support for / opposition to shale gas development via three variables in the survey: support/opposition to shale gas development in your community, in your state, and in the USA. A factor analysis of these three variables, with principal components extraction, listwise deletion, and varimax rotation, generated one factor, with all loadings greater than 0.96, an eigenvalue of 2.851, and an explained variance of 95.02%. A reliability analysis of these three variables produced a Cronbach's alpha of 0.973. This indicates that all three variables measure

the same underlying construct regardless of geographic context. This finding suggests that the so-called NIMBY phenomenon, which some scholars have suggested might apply to shale gas development (Krause *et al.* 2014), is not likely relevant for shaping representations of support/opposition in my survey sample.

In my second factor analysis I analyzed all beliefs about impacts. First, I conducted an analysis of the beliefs about likelihood of the twenty-four impacts; then I analyzed beliefs about the impacts' effect on quality of life. Finally, I conducted a factor analysis of a combined variable – in which I multiplied the value for likelihood (on a scale of 0-3) by the value for effect on quality of life (on a scale of 0-3) for each impact. Each factor analysis produced similar results in terms of number of factors, factor loadings, and eigenvalues; I report on the factor analysis for the combined variable here. Psychometric measurements of risk often combine probability (in our survey, likelihood) and severity (in our survey, effect on quality of life) (Renn 1998, Slovic 1987).

The analysis produced three factors; twenty of the twenty-four impacts fit nicely into one of the two first factors. I removed the four impacts that did not fit with either of the two primary factors (i.e., increased rental housing prices, increased industrialization, preservation of agricultural land, and decreased greenhouse gas [carbon] emissions) and re-ran the analysis (Table 6.24).

Table 6.24. Factor analysis of beliefs about impacts (likelihood * effect on life)

	Component	
	1 (Beliefs about Risks)	2 (Beliefs about Benefits)
Increased jobs (**L**ikelihood * **E**ffect on life)	-.212	**.841**
Short-term local economic growth (L * E)	-.080	**.816**
Long-term local economic growth (L * E)	-.333	**.824**
Lowered property values (L * E)	**.661**	-.216

Lower taxes locally (L * E)	-.140	**.517**
Less tourism locally (L * E)	**.589**	-.077
Personal income from royalty / lease (L * E)	-.192	**.722**
Increased traffic (L * E)	**.738**	.033
Worse road quality (L * E)	**.775**	-.238
Changes in community character (L * E)	**.844**	-.123
Decreased local beauty (L * E)	**.839**	-.347
Dec. quality of outdoor recreation (L * E)	**.829**	-.306
Increased crime (L * E)	**.725**	-.098
Decreased peace & quiet (L * E)	**.818**	-.257
Increased stress (L * E)	**.808**	-.273
Decreased personal / family health (L * E)	**.764**	-.333
Increased energy independence (L * E)	-.186	**.660**
Decreased air quality (L * E)	**.808**	-.334
Decreased water quality (L * E)	**.778**	-.397
Decreased fish & wildlife health (L * E)	**.794**	-.358

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

Two factors emerged. The highest cross-loading between factors has an absolute value of 0.397. The lowest loading within factor 1 is 0.589, and the lowest loading within factor 2 is 0.517. The eigenvalues were 10.53 for factor 1 and 2.35 for factor 2, leading to an explained variance of 52.7% and 11.7%, for a total variance explained between the two factors of 64.4%. A reliability analysis of the fourteen impacts in factor 1 produced a Cronbach's alpha of 0.960. Deletion of only one impact would increase reliability, and only by 0.002. A reliability analysis of the six impacts in factor 2 produced a Cronbach's alpha of 0.854. Deletion of only one impact would increase reliability, and only by 0.008.

Whereas I had previously, in my coding of newspaper articles and coding of the open-ended question from the survey, used "environmental", "social", and "economic" as the three dominant categories of impacts, only two categories of impacts were manifest in the factor

analysis. Factor 1 is composed entirely of negative impacts (risks) and factor 2 is made up of only positive impacts (benefits). The emergence of these two factors suggests that survey respondents assessed likelihood of impacts and effects on quality of life of those impacts based on their perceptions of whether the impacts were good or bad, as opposed to in relation to the *category* of impact into which they fit (e.g., environmental, economic, or social). The factor analyses clearly show that social, environmental, and economic impacts all pool together well, as long as the impacts are negative; likewise, social and economic impacts pool together as long as they are positive.

My final factor analysis was of ethical rationales for decision making on shale gas development. I analyzed the nine variables in Table 6.3. The first eight variables pooled together as one factor and the final variable (i.e., "people's rights to use their property as they want to") emerged as a second component (see Table 6.25). The highest cross-loading between the components has an absolute value of 0.143. The lowest loading within factor 1 is 0.736. The eigenvalues were 4.95 for component 1 and 1.01 for component 2, leading to an explained variance of 54.98% and 11.27%, for a total of 66.25%. A reliability analysis of the eight impacts in factor 1 produced a Cronbach's alpha of 0.908. The reliability score would not increase with deletion of any item.

Table 6.25: Factor analysis of ethical rationales for decision making on shale gas development

	Component	
	1	2
Ethics - prevent harm at all costs	**.783**	.010
Ethics - Use caution in uncertainty	**.853**	-.102
Ethics - Weigh all risks and benefits	**.824**	.062
Ethics - Distribution of risks and benefits	**.741**	.143
Ethics - Fair and transparent process	**.753**	.062
Ethics - Citizens need a say in decision making	**.736**	.052
Ethics - Preserving community way of life	**.767**	.096

Ethics - Rights to clean air and water	**.816**	-.028
Ethics - right to use property as want to	.045	**.990**

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

I found it difficult to characterize the first factor in this final factor analysis in a unified way. From the philosopher's or ethicist's perspective, these eight ethical considerations represent substantially different underlying constructs, yet the data indicates that respondents treated these items very similarly. Preventing harm *at all costs* (emphasis original in the survey) can be thought of as a deontological, rule-based argument, which could be contrasted strongly against weighing all risks and benefits – a utilitarian, consequentialist approach. Likewise distributive justice and procedural justice, while both identified as important considerations in the newspaper articles and interviews, are rather different approaches to decision making on shale gas development. The one major difference between the first eight items and the final item in Table 6.25 is that the first eight have been frequently used a rationales to oppose shale gas development and the final ethical consideration has been used as a rationale to support development. "Weighing of risks and benefits" is the only item that does not fit clearly into this framework, but from my limited exposure to this representation in newspaper articles, interviews, and informal conversations, it seems to be used more frequently in opposition to development than in support of development.

B. Linear regressions

Much of the extant empirical research and theoretical literature on public perceptions of shale gas development contends that the primary predictor of support for / opposition to development is beliefs about impacts (Brasier *et al.* 2011, Jacquet and Stedman 2013, Kriesky *et al.* 2013, Ladd 2013, Schafft *et al.* 2013, Theodori 2009, Theodori 2013, Wynveen 2011). I used this literature as a point of departure for investigating factors that contribute substantially to

representations about shale gas development. In my first regression, I included a composite measure of support/opposition as the dependent variable. I used the average of support/opposition for development in the community, state, and nation, because the factor analysis indicated such a strong relationship between the measures. I added only two independent variables: (1) a composite measure of beliefs about risks associated with development (i.e., the fourteen impacts in factor 1 in Table 6.24) and (2) a composite measure of beliefs about benefits associated with development (i.e., the six impacts in factor 2 in Table 6.24).

This first linear regression revealed a very strong relationship between risks, benefits, and support/opposition (see Table 6.26). The model had an adjusted R-square of 0.731, indicating that 73% of the variance in the dependent variable could be explained by just the two independent variables.

Table 6.26: Linear regression with benefits and risks regressed on support/opposition

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	Beta	Std. Error	Beta		
(Constant)	4.525	.110		41.022	.000
Beliefs about risks (composite variable)	-.417	.015	-.607	-27.683	.000
Beliefs about benefits (composite variable)	.296	.018	.359	16.374	.000

Dependent Variable: Support for / opposition to shale gas development (combined across community, state, and nation)

Initially, this finding seems to support the contention of previous researchers that beliefs about impacts are the primary factor that predicts support for / opposition to shale gas development. The R-square value for the regression in Table 6.26 is even higher than reported values for regressions of beliefs about impacts on support/opposition in previous research.

Nevertheless, this interpretation requires caution. Regressions indicate the extent to which a relationship exists between a single variable and one or more other variables. A high R-square value and high standardized beta coefficients reveal a strong relationship. The causal direction of the relationship, however, must be hypothesized in advance – it cannot be deduced from the data alone. In previous research, the aforementioned scholars have assumed (based on the theories on which they have relied and intuitive logic) that beliefs about impacts shape representations of support for / opposition to development. The factor analyses presented above, however, challenge that logic.

The possibility that support/opposition might lead to beliefs about impacts (and not vice versa), led me to try to identify other variables that could theoretically and logically shape representations of support/opposition. Social representations theory hypothesizes that aspects of social structure, values, and historical experience in a community will fashion and mold representations. I explored relationships between these variables and support/opposition through a number of linear regressions. In Table 6.27, I present the results of one such regression.

Table 6.27: Linear regression of support/opposition on multiple predictors

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	Beta	Std. Error	Beta			Tolerance	VIF
(Constant)	2.615	.975		2.682	.008		
Age (in years)	.025	.008	.188	3.204	.002	.826	1.210
Sex (1 = Male, 0 = Female)	.647	.220	.167	2.937	.004	.884	1.132
Pos./neg. experience with resource extraction	.477	.132	.208	3.611	.000	.860	1.163
Have lease? (1 = Yes, 0 = No)	1.351	.228	.340	5.933	.000	.866	1.155
Signs about gas drilling in your community	-.349	.149	-.137	-2.349	.020	.840	1.190

"My community is special as is; I would not want any change"	-.305	.072	-.243	-4.253	.000	.873	1.145
"A first consideration of a good political system is protection of private property rights"	.271	.112	.137	2.421	.017	.887	1.127
"The balance of nature is very delicate and easily upset by human actions"	-.406	.117	-.218	-3.472	.001	.726	1.378

Dependent Variable: Support for / opposition to shale gas development (combined across community, state, and nation)
Adjusted $R^2 = 0.55$.

Males are more likely to support development, as are older people. The next item in Table 6.27 measures, on a four-point scale, the extent to which respondents' historical experience with resource extraction has been positive or negative (see Table 6.5, second half). This variable is a composite measure – the average of the first four items in Table 6.5: natural gas drilling, oil drilling, coal mining, and other mining[26]. Unsurprisingly, the more positive one's historical experience with resource extraction, the more likely one is to support shale gas development.

People who have gas leases on their property are much more likely to support development. The causal here is unclear; people could sign leases because they support development, or they could sign leases knowing little about development and then evaluate development based on their experiences. Feedback loops may exist between leasing land and support/opposition. People who see signs about shale gas development more frequently in their community are more likely to oppose development.

[26] A factor analysis, using principal components extraction and varimax rotation, generated one factor. The lowest factor loading was 0.679; the factor had an eigenvalue of 2.62, and an explained variance of 65.6%. A reliability analysis produced a Cronbach's alpha of 0.818.

The final three variables in the regression measure values. Respondents who are more reticent to accept change in their community oppose development much more strongly. Respondents who value the importance of private property rights support development more. Finally, respondents who more strongly agree that the balance of nature is are more likely to oppose development.

Equally interesting as the variables that I included in this regression are the variables that I left out due to not improving or decreasing model fit. Political views have been shown in previous research to be predictive of support for / opposition to shale gas development. Regressing support/opposition on political views alone, in the survey data, generates a large standardized beta weight that is statistically significant at $p < 0.001$ and an R-square of 0.152. Nevertheless, political views are not a significant predictor when added to the larger regression model (in Table 6.27). The R-square value increases by 0.000 and the parameter estimate for political views has a p-value of 0.442. Equally noteworthy is that neither experience with natural gas drilling nor educational attainment improve the model R^2 or generate a coefficient with a statistically significant p-value.

C. Structural equation models

Structural equation models allow one to conduct multiple factor analyses and regressions simultaneously, while also regressing the latent variables created from the factor analyses on each other. Additionally, these models use confirmatory factor analysis (CFA), not the exploratory factor analysis (EFA) that is most common for dimension reduction (and which I used in the factor analyses above). CFA includes the added constraint that all factor loadings other than those explicitly specified as loading onto a factor are set at zero, whereas EFA permits all variables included in the model to freely load on each factor.

I used structural equation modeling (SEM) to test whether the relationships revealed in the factor analyses and regressions cited above offered a good explanation of my survey data when combined together. I also relied on SEM to test the relationship between beliefs about

impacts and representations of support/opposition. SEM allows for hypothesis testing about directionality in causal relationships.

1. Single-level structural equation model

I present my initial model in Figure 6.4 (the M*plus* code I used for this model is in Appendix J). All of the squares in the model represent measured variables from my survey. Variables starting with "v" are items that I measured directly. Items starting with "m" are composite variables created by multiplying the value, for each respondent, of beliefs about likelihood of a given impact with beliefs about effect on quality of life of that impact (both on a 0-3 scale). In Table 6.28 I list the variable in my survey to which each square in Figure 6.4 refers; I also define each latent variable (represented by circles).

Arrows pointing from squares to circles are regression pathways of latent variables (the dependent variables) regressed on measured variables (independent variables); the coefficients listed in Figure 6.4 on these pathways are standardized beta coefficients. Arrows pointing from circles to squares (and the numbers on those pathways) represent factor loadings; these squares are the variables that compose the factor represented by the latent variable. Arrows between two latent variables (circles) either represent regression pathways (e.g., "risks" is regressed on "support") or second-order factor loadings (e.g., "beauty", "character", "health", and "environ" are latent variables that together with m5 and m7 load onto the second-order factor "risks"). Curved lines represent covariances that account for correlational relationships between two continuous latent variables (e.g., "resilnce" and "sustain") or between a latent variable and an observed variable (e.g., "growth" and m9). All pathways in the model are significant at $p < 0.05$.

Figure 6.4: Structural equation model of multiple relationships in the NY/PA survey

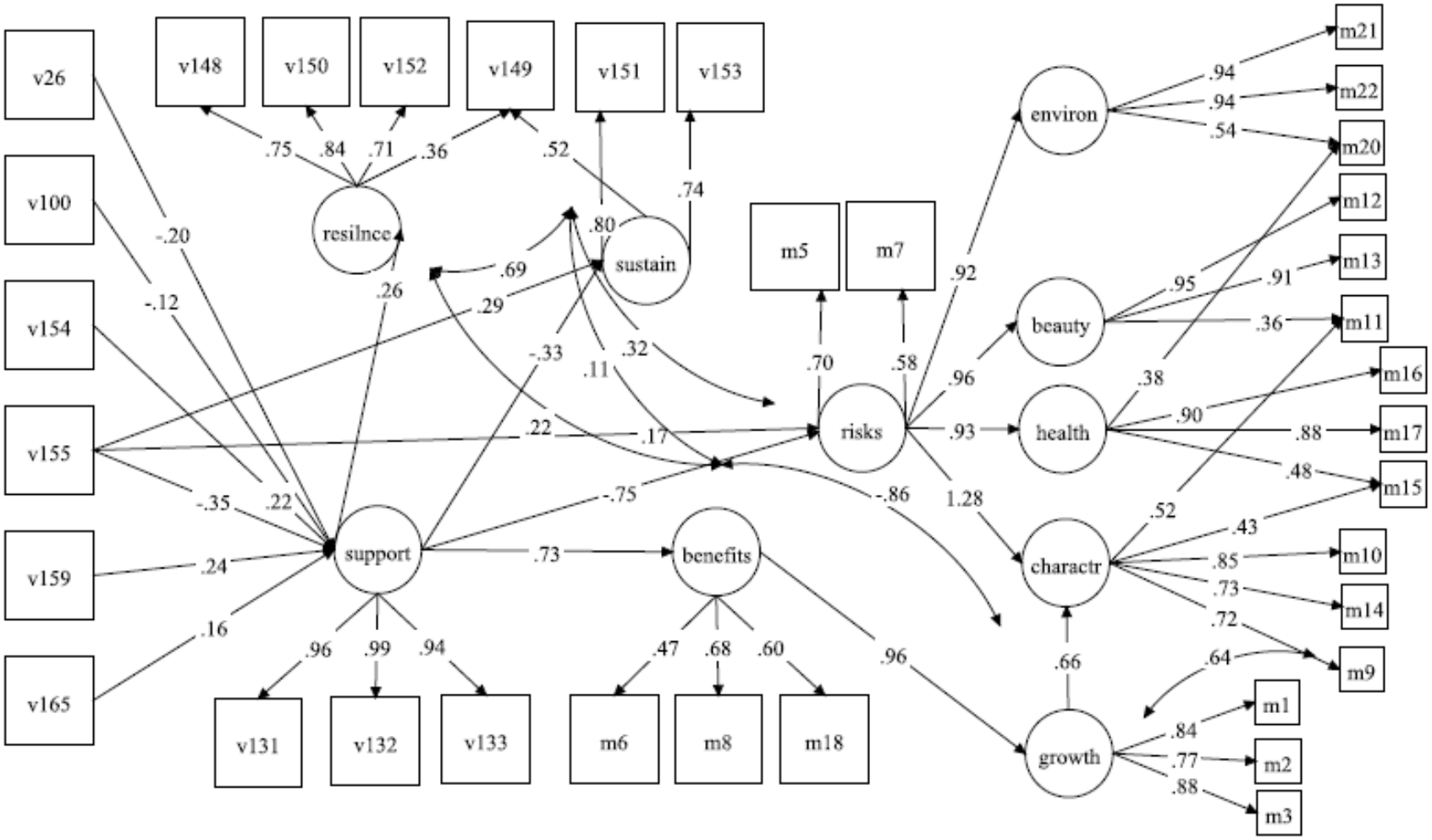


Table 6.28: Variables in the structural equation model in Figure 6.4

Measured Variables
v26 – "My community is special to me as it is; I would not want anything to change."
v100 – How commonly see "signs supporting / opposing gas drilling" in your area?
v131 – Do you support or oppose shale gas development in your community?
v132 – Do you support or oppose shale gas development in your state?
v133 – Do you support or oppose shale gas development in the USA?
v148 – Importance of: "Being a community that can 'reinvent' itself"
v149 – Import of: "Integrating economic, environmental, and social issues in decision making"
v150 – Importance of: "Being able to absorb and adapt to change"
v151 – Importance of: "Considering future consequences of decisions"
v152 – Importance of: "Having a diverse economy"
v153 – Importance of: "Understanding 'tipping points' in how much stress the local environment can handle"
v154 – "A first consideration of a good political system is protection of private property rights."
v155 – "The balance of nature is very delicate and easily upset by human activities."
v159 – "Do you have a gas or oil lease on your property?" (0 = No, 1 = Yes)
v165 – "How would you describe your political views?" (1, very liberal – 7, very conservative)

Composite Variables (likelihood * effect)	m18 – Increased energy independence
m1 – Increased jobs for locals / our children	m20 – Decreased air quality
m2 – Short-term local economic growth	m21 – Decreased water quality
m3 – Long-term local economic growth	m22 – Decreased fish & wildlife health
m5 – Lowered property values	
m6 – Lower taxes locally	**Latent Variables (circles)**
m7 – Less tourism locally	support – Support / opposition across 3 levels
m8 – Personal income from leasing / royalties	risks – 14 negative impacts
m9 – Increased traffic	beauty – 3 impacts related to aesthetics
m10 – Worse road quality	charactr – 5 impacts about community character
m11 – Changes in community character	health – 4 impacts related to health issues
m12 – Decreased local beauty	environ – 3 environmental impacts
m13 – Decreased quality of outdoor recreation	benefits – 6 positive impacts
m14 – Increased crime	growth – 3 impacts related to economic growth
m15 – Decreased peace and quiet	sustain – 3 measures of import of sustainability
m16 – Increased stress	resilnce – 4 measures of import of resilience
m17 – Decreased personal / family health	

The structural equation model (SEM) in Figure 6.4 reveals that the aforementioned factor analyses and regressions still provide a good description of the structure of the survey data when combined. I have made a few changes: (1) in the SEM, age and sex no longer were significant predictors of support/opposition; I removed them from the model, (2) the SEM allows for second-order factor analyses, which I conducted for both risks and benefits, and (3) unlike in the foregoing linear regression, political views significantly predicted support/opposition in the SEM; I included it in the model.

In the SEM, beliefs about the fourteen negative impacts pool to form the factor "risks" and beliefs about the six positive impacts pool to form the factor "benefits". The variables that best predicted support/opposition in the final linear regression I present above (i.e., v26, v154, v155, and v159) still have relatively high absolute values for the standardized beta weights in the SEM (see Figure 6.4). In the SEM I also added structural pathways from the latent variable 'support' to the latent variables representing sustainability and resilience. These pathways reveal that support/opposition conditions respondent beliefs about the importance of sustainability and resilience for a positive future in communities like theirs. The standardized beta coefficients of 0.26 for resilience and -0.33 for sustainability indicate that support for development leads to greater importance of the four items making up the factor "resilnce", whereas opposition to development leads to greater importance of the three items comprising the factor "sustain".

The SEM demonstrates further that support for / opposition to shale gas development strongly predicts beliefs about risks and benefits of development (see Figure 6.4 and Table 6.29). I use causal language here because the statistical assumptions of structural equation modeling allow for hypothesis testing of causal pathways as long as the hypothesized directionality is theoretically sound. (In Chapter Seven I discuss why social representations theory and other theories would predict this directionality.) Importantly, the SEM in Figure 6.4 has better fit than the same model with the only change being that the directionality of the two pathways from support/opposition to "risks" and "benefits" were reversed (see Table 6.29).

Table 6.29: Fit index comparisons, single-level SEM

	Model 1	Model 2
Standardized Parameter Estimates		
'risks' on 'support'	-0.747*	---
'benefits' on 'support'	0.733*	---
'support' on 'risks'	---	-0.621*
'support' on 'benefits'	---	0.361*
Measures of Model Fit		
χ^2 (d.f.)	1,568* (523)	2,189* (526)
χ^2 (d.f.), baseline model	20,916* (580)	20,916* (580)
CFI	0.949	0.918
RMSEA	0.050	0.063
RMSEA (90% C.I.)	0.047 – 0.053	0.060 – 0.065
SRMR	0.042	0.161

*p < 0.001, †p < 0.01, ‡p < 0.05

Model 1 = the model depicted in Figure 6.4; Model 2 = that model with the direction of two structural pathways reverse, so that 'risks' and 'benefits' predict 'support'.

Under Standardized Parameter Estimates, the word 'on' (e.g., 'risks' on 'support') should be interpreted as the latent variable 'risks' *regressed on* the latent variable 'support' (i.e., in this case, 'support' predicts 'risks').

The fit indices for Model 1 in Table 6.29 indicate a well-fitted model across all metrics; the fit for Model 2 is borderline adequate on one index and poor on the other indices. Because "different indices reflect different aspects of model fit", a review of several experts' recommendations on which fit indices to use has revealed that the RMSEA, CFI, SRMR and chi-square statistics provide a relatively comprehensive description of the model fit (Hooper *et al.* 2008, 56). RMSEA (root mean square error of approximation) values close to 0.050 (and lower) are generally viewed as exhibiting good fit, while values less than 0.06 or 0.07 are considered the upper limit for adequate fit (Hooper *et al.* 2008). CFI (comparative fit index) values greater than 0.90 were originally thought to indicate good fit; more recently, this baseline has shifted closer to 0.95 (Hooper *et al.* 2008). SRMR (standardized root mean square residual) values of 0.05 or less reveal good fit, with values between 0.05 and 0.08 indicating adequate model fit.

Structural equation models often perform better on one index than another. Taken together, the finding of good fit from the three indices reveals that Model 1 provides a strong description of the underlying structure of the survey data. In Model 2, however, one of the indices declined to adequate fit (RMSEA), one declined to borderline adequate/poor fit (CFI), and one declined to poor fit (SRMR). Model 2, with the reserved causal direction of the two structural pathways, does not describe the data structure well.

Ideally, the model chi-square test would generate a non-significant p-value (i.e., $p > 0.05$), but in practice, especially for data sets with large sample sizes and/or many parameters, this is not possible even for the best fitting models. The more meaningful comparison is to ensure that the chi-square for the model exhibits a substantial improvement over the chi-square of the baseline model (i.e., the model chi-square should be less). This is true for both models in Table 6.29, but the improvement in fit is more substantial for Model 1.

2. Single-level model accounting for complex structure of the survey data

After obtaining good fit for the basic single-level SEM presented in Figure 6.4, I ran series of SEMs to account for the hierarchical structure of the data. As discussed in Chapter Three, because I measured representations of shale gas development across multiple communities, and because social representations theory postulates that numerous community-level elements shape representations, one cannot presume that responses within a community represent independent observations (an assumption of most statistical modeling). To properly account for variability at both levels of analysis and to adequately represent the standard error in the data, I created SEMs that accounted for the multilevel character of the data.

First, I designed a SEM that included the municipality from which each respondent came as a stratification variable. For this analysis, I combined a few of the municipalities that I surveyed. Due to low sample sizes, I pooled the data sets for six sets of two municipalities each. Each pooled set maintained geographic proximity and similar socio-economic and population

characteristics. My final sample size at the group level was 28 municipalities. The stratified SEM was identical to the model in Figure 6.4, save the stratification (the M*plus* code I used for this SEM is in Appendix K). Stratification is a way of dealing with complex survey data; it creates a single model for the whole survey population that accounts for non-independence of observations – generating more accurate estimates of standard error than one would receive without the stratification. This model, once again, had excellent fit: RMSEA = 0.046 (90% confidence interval: 0.043-0.049; probability RMSEA < 0.05 is 0.983), CFI = 0.947, SRMR = 0.042.

3. Two-level structural equation models

Following the stratified SEM, I designed a two-level SEM. Two-level modeling is similar to stratifying a sample, except that this approach generates a separate model for each group (in my case, each of my 28 municipalities) and it allows for modeling of variables that exist (and are measured) at the group, as opposed to individual, level. Due to the computational complexity of two-level modeling, I constructed my two-level model with fewer parameters than I included in the model in Figure 6.4. On the within-group level I included: (1) the second-order factor analyses of risks and benefits (as in Figure 6.4) and (2) a pathway to each of these two latent variables from the latent variable measuring support/opposition (created by a factor analysis of the three support/opposition variables). On the between-group level, I used basically the same model as in the within-group model, but I only included first-order factor analyses for risks and benefits. That is, I did not construct any intermediate factors (e.g., "environ", "beauty", and "growth" from Figure 6.4) between beliefs about impacts and the latent variables of "risks" and "benefits". In the final between-groups model, I also included the percent of that county's residents who voted for Obama in 2012 as a predictor variable. The M*plus* code I used for this SEM is in Appendix L.

When testing two-level SEMs (before settling on the model described above), I included several additional group-level predictor variables for support/opposition. Because societal-level variables have a variance of zero *within* a municipality, they are only appropriately included in statistical modeling if the modeling allows for a hierarchical structure to the data. The variable measuring societal-level political views was the only societal-level variable that generated a parameter estimate with a significant p-value when included as a predictor of support/opposition. As expected, the greater percentage that voted for Obama, the greater average opposition the municipality had to shale gas development. The other, non-significant, societal-level variables I tested in the SEM were: total population in the municipality, population density, percent of town residents with a bachelor's degree, poverty rate, unemployment rate, and median household income – all of which had no statistically significant effect on municipality support/opposition for shale gas development. Additionally, in a model of only the PA subpopulation from the survey, three other societal-level variables were non-significant in predicting support/opposition: number of wells per municipality, number of wells per county, and percent of wells in the municipality that accrued DEP (Department of Environmental Protection) violations.

The final two-level model (with only the one between-groups predictor variable) indicates that the relationships described in the previous SEMs are still robust when modeled at the level of each community individually. Nevertheless, this model had good fit on some indices and poor fit on others: RMSEA = 0.024 (no confidence interval is generated for two-level models), CFI = 0.923, $SRMR_w$ (SRMR for the within-groups model) = 0.039, and $SRMR_B$ (for the between-groups model) = 0.178.[27] Based on the two-level SEM fit indices, the within-groups model clearly fits well, but the between groups model does not. A likely explanation for this

[27] Because two-level models behave differently than single-level models, Hsu (2009) provides evidence for different cut-off values for adequate fit, compared to single-level models: RMSEA < 0.054, CFI > 0.97, $SRMR_W$ < 0.052, $SRMR_B$ < 0.044-0.060. Hsu (2009) also notes that due to the way in which these indices are derived, RMSEA, CFI, and $SRMR_w$, irrespective of how they are interpreted in single-level models, only provide evidence for the fit of the within-groups model in two-level models. The RMESA and CFI indices are not sensitive to misspecifications on the between-group level because they are based on the chi-square statistic, which is derived from overall sample size. The sample size of the within-group level overwhelms the sample size of the between-group level when the overall model chi-square statistic is computed.

result is the very small sample size at the group level. Indeed, statisticians have suggested that a sample size of anywhere from 100-200 could be needed at the group level to achieve adequate model fit (Byrne 2012, Hsu 2009); nevertheless, in a few examples, sample sizes near thirty have been adequate (Byrne 2012).

The $SRMR_B$, the only index that measures between-groups fit in a two-level model, exhibited by far the worst fit. SRMR, however, is rather sensitive to the number of parameters in the model and the sample size – it increases as there are fewer parameters and a smaller sample size (Hooper *et al.* 2008). The sample size of 28 municipalities was likely too small to generate statistical significance. SRMR is calculated from the difference of the residuals between the sample and hypothesized covariance matrices. The standard errors of the residual variances for the between-groups variables were between two to ten times larger than the standard errors of the residual variances for the within-group variables, due to the small between-groups sample size.

Despite the poor model fit at the group level, in a Bayesian estimation analysis of this same two-level model, all freely-estimated parameter estimates in the between-level model were statistically significant, save three of the fourteen factor loadings on the risk factor (worse road quality, increased crime, decreased peace and quiet) and one of the six factor loadings on the benefits factor (lower taxes locally). The M*plus* code I used for this SEM is in Appendix M. Bayesian estimation may be more appropriate for two-level models with a small sample size at the group level. The Bayesian credibility interval (for determining statistical significance) is "based on the percentiles of the posterior [and] allows for a strongly skewed distribution" (Muthén and Asparouhov 2012, 314). This could be a necessary allowance in the presence of small sample size. Nevertheless, the traditional Bayesian fit indices of posterior predictive checking, posterior predictive p-value, and deviance information criterion have not yet been developed for two-level models. Thus, I propose using the Bayesian estimation results to report on the significance of the parameter estimates while using the weighted least squares estimation to report the fit indices for the two-level model.

In an attempt to generate a two-level SEM with good fit at both levels, I focused solely on a model that sought to describe factors influencing support/opposition (i.e., I created a much more parsimonious model than my previous models by removing any reference to beliefs about impacts). The model reveals that six variables measured on the individual level and one variable measured on the societal level are strong predictors of support/opposition when modeled individually within each community and modeled cumulatively across the communities (Table 6.30). This two-level SEM had excellent fit: RMSEA = 0.019, CFI = 0.993, $SRMR_W$ = 0.022, and $SRMR_B$ = 0.037. The only measurement part of the model (i.e., confirmatory factor analysis) was of the three measures of support/opposition on a single support/opposition latent variable at each level (i.e., within and between). The M*plus* code I used for this SEM is in Appendix N.

Table 6.30: Parameter estimates for two-level SEM of variables predicting support/opposition

Variable	Standardized Parameter Estimate	Two-tailed p-value
Within-groups model		
Balance of nature is delicate and easily upset	-0.372	0.000
Have an oil/gas lease? (0 = No, 1 = Yes)	0.226	0.000
Like community "as is"; not desire change	-0.206	0.000
Important to protect private property rights	0.223	0.000
Political views (1-7, liberal–conservative)	0.151	0.000
See signs about development in community	-0.094	0.005
Between-groups model		
County-level political views	-0.790	0.000

VI. Representations of Development in Relation to Sustainable, Resilient Communities

Before including the confirmatory factor analyses for the latent variables representing sustainability and resilience in the SEM in Figure 6.4, I conducted an exploratory factor analysis of the six items (principal component extraction with varimax rotation). Two distinct factors

emerged. The highest cross-loading between factors, not counting the one item that was intended to load on both factors, has an absolute value of 0.227. The lowest loading within the resilience factor was 0.551, and the lowest loading within the sustainability factor was 0.619. The eigenvalues were 3.31 for resilience and 1.14 for sustainability, leading to an explained variance of 55.1% and 18.9%, for a total of 74.0%. A reliability analysis of the four items in resilience produced a Cronbach's alpha of 0.832. A reliability analysis of the three items in sustainability produced a Cronbach's alpha of 0.794. The data from this factor analysis and these reliability analyses confirm the strong separation into two separate concepts of the items intended to measure each factor.

Following the exploratory factor analysis, but before I ultimately included sustainability and resilience as latent variables in the structural equation model, I conducted a linear regression to test the relationship between support/opposition and the two factors. I created composite variables for sustainability and resilience by averaging the values of the component items. I then regressed these two composite variables on the composite variable for support/opposition (i.e., the variable that averaged support/opposition across community, state, and USA). The results of this regression provided a strong indication that support for development is associated with beliefs about the importance of resilience (standardized beta coefficient of 0.490, $p < 0.001$), and that opposition to development is associated with beliefs about the importance of sustainability (standardized beta coefficient of -0.578, $p < 0.001$). The model adjusted R^2 was 0.288.

After reviewing the results of the linear regression, I proceeded to test the combined regression and factor analyses in the structural equation model. The reader will notice that the causal directionality of the regression pathways between support/opposition and the two factors are reversed in Figure 6.4 from the linear regression. It makes greater sense logically to posit that support/opposition affects resilience and sustainability, than vice versa, because the survey question about these two factors asked "How important do you think the following are to a positive future for communities like yours?" Due to these questions looking into the future, prior

experience with and views on shale gas development should likely be viewed as antecedent. Additionally, a structural equation model with all the same variables and pathways, but with the only variation being that the pathways between support/opposition and resilience and sustainability were reversed, had worse fit than the model in Figure 6.4 (RMSEA = 0.053 [90% confidence interval = 0.050-0.055], CFI = 0.919, SRMR = 0.065).

The pathways from support/opposition to the latent variables representing sustainability and resilience in Figure 6.4, along with the strong factor loadings on the component items for these factors, demonstrate that people who oppose shale gas development are more likely to think that sustainability is important for the future of communities like theirs, while people who support shale gas development are more likely to think that resilience is important. The opposite direction of the effect of support/opposition on sustainability and resilience is surprising because much scholarly work on the concepts of sustainability and resilience links these two concepts as working toward similar goals. For example, Folke (2006, 260) writes, "The resilience approach provides one among several arenas for generating integrative science and interdisciplinary collaboration on issues of fundamental importance for governing and managing a transition toward more sustainable development paths…".

Resilience is often seen as leading to sustainable development. While sustainable development and sustainability are not the same thing, I have never before heard it suggested that sustainability and resilience are opposed to each other. Nevertheless, support/opposition for development has the opposite effect on the four items representing resilience as it does on the three items representing sustainability (note: I included one of the six items in both factors because the importance of "integrating economic, environmental, and social issues in decision making" is a central component of both sustainability and resilience).

The finding that higher levels of support for shale gas development lead to less importance of sustainability for a community's future, but to more importance of resilience for a

community's future, is intriguing. This result has implications for communication about shale gas development; I discuss these in Chapter Seven.

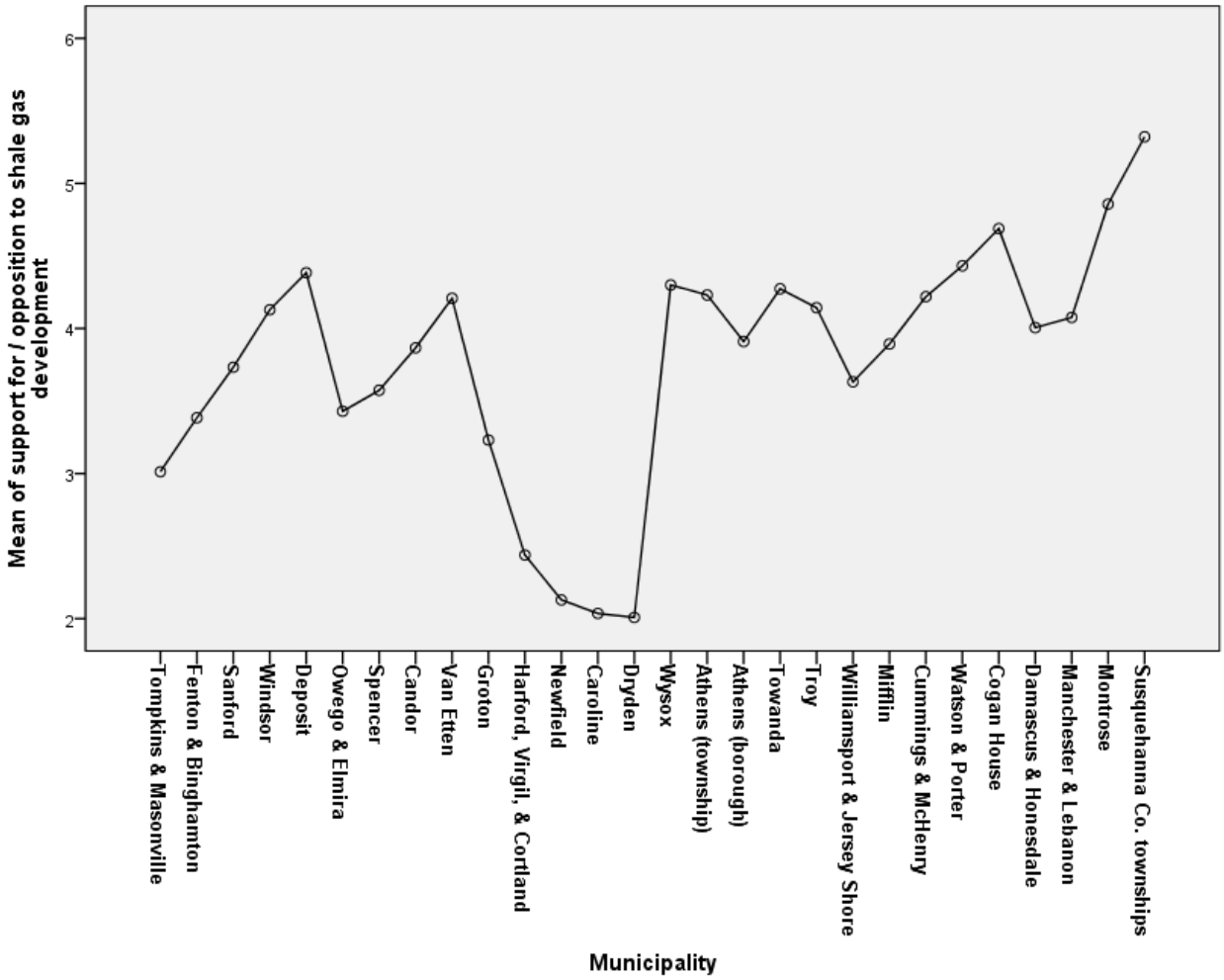
VII. Comparison of SR across Municipalities

Having demonstrated that SR of shale gas emerge from local history, social structure, and values, I now examine the degree to which those representations can be classified as *social*. One approach to analyzing the extent to which representations of shale gas development are social is to examine the degree of variation in representations across communities. In my interviews and in the newspaper content analysis (reported in Chapters Four and Five), I studied one type of variation – whether the *types* of representations that were discussed differed by place. For example, procedural justice concerns were of a different type in NB compared to NY – industry having too much influence on government (in NB) versus citizens having adequate time to provide feedback on the NYDEC environmental impact statement (in NY). Here, I examine another type of variation in representations – whether the *degree* of agreement with major representations differs across communities.

I explore the variation in representations through generalized linear models. The models I constructed are similar to a one-way ANOVA in that they allow for comparison of differences between municipalities. Nevertheless, the generalized linear models are more informative, in that they permit the researcher to assess the contribution of each individual municipality to the overall difference, whereas the ANOVA generates a single F-statistic. An initial ANOVA with support/opposition as the dependent variable and municipality as a factor generated an F-statistic of 9.88, with $p < 0.001$, indicating that the generalized linear model could be useful for understanding differences between municipalities. A plot of means for support/opposition across the municipalities revealed large differences (see Figure 6.5). The first five municipalities in this figure are from Broome and Delaware Counties (NY), the next four are from Tioga and Chemung Counties (NY), and the next five are from Tompkins and Cortland Counties (NY).

The PA municipalities begin with Wysox. The first five PA municipalities are from Bradford County, the next five are from Lycoming County, the next two are from Wayne County, and the final two are from Susquehanna County.

Figure 6.5: Plot of means from a one-way ANOVA of support/opposition by municipality



A. Model with support/opposition as the dependent variable

I created a generalized liner model with a normal probability distribution and an identity link function, with support for / opposition to shale gas development as the dependent variable. The model had a p-value < 0.001 based on the likelihood ratio chi-square test statistic of 243.6. The Wald chi-square test for the parameter estimates in this model revealed that all of

municipalities, save Cogan House and Montrose, had beta values significant at $p < 0.05$ (the Susquehanna County townships were used as the reference category).

I then ran the same model with eight other variables from my survey as covariates (reported in the section on linear regressions below). This led to eleven municipalities having a beta value significant at $p < 0.05$ for the Wald chi-square test (compared with twenty-five in the previous model). This analysis reveals that those variables from the linear regression (reported later in this chapter) can explain substantial variation between communities in why people support/oppose shale gas development. For the purposes of this section, however, I will continue to report results from the generalized linear models without any covariates. This seems more appropriate for examining the extent to which social representations may be social, because SR theory dictates that representations will vary across communities *because of* cultural, social structural, and historical variables, not *in spite of* them.

In this first generalized linear model, Dryden (NY) had the lowest estimated marginal mean of any municipality (meaning opposition was highest in Dryden; see Table 6.31). In pairwise comparisons, Dryden had a significantly lower estimated marginal mean than twenty-two of the twenty-seven other municipalities – that is, all except five other NY municipalities: Tompkins & Masonville; Harford, Virgil, and Cortland; Caroline; Groton; and Newfield (based on $p < 0.05$, with sequential Bonferroni corrections for multiple comparisons). The combined municipalities of Dimock, Springville, Bridgewater, & Brooklyn (PA) had the highest estimated marginal mean of any municipality (meaning support was highest there). In pairwise comparisons, these combined townships had a significantly higher marginal mean than thirteen of the twenty-seven other municipalities – that is, all NY municipalities except Windsor, Van Etten, and Deposit, but only Damascus & Honesdale and Williamsport & Jersey Shore in PA.

Table 6.31: Estimated marginal means from generalized linear model with support/opposition as the dependent variable and municipality as the factor variable

Municipality	Mean	Std. Error	95% Wald Confidence Interval	
			Lower	Upper
Dryden	2.01	.27	1.49	2.53
Caroline	2.04	.27	1.50	2.57
Newfield	2.13	.30	1.54	2.72
Harford, Virgil, & Cortland	2.44	.22	2.02	2.86
Tompkins & Masonville	3.01	.33	2.37	3.65
Groton	3.23	.27	2.71	3.75
Fenton & Binghamton	3.38	.23	2.93	3.84
Owego & Elmira	3.43	.23	2.98	3.88
Spencer	3.57	.28	3.03	4.12
Williamsport & Jersey Shore	3.63	.31	3.03	4.24
Sanford	3.73	.28	3.18	4.28
Candor	3.87	.24	3.41	4.33
Mifflin	3.89	.33	3.24	4.55
Athens (borough)	3.91	.33	3.27	4.55
Damascus & Honesdale	4.01	.22	3.58	4.43
Manchester & Lebanon	4.08	.28	3.52	4.63
Windsor	4.13	.30	3.54	4.72
Troy	4.14	.28	3.59	4.69
Van Etten	4.21	.26	3.69	4.72
Cummings & McHenry	4.22	.27	3.69	4.75
Athens (township)	4.23	.33	3.59	4.87
Towanda	4.27	.32	3.66	4.89
Wysox	4.30	.30	3.70	4.90
Deposit	4.38	.33	3.74	5.02
Watson & Porter	4.43	.32	3.80	5.06
Cogan House	4.69	.25	4.21	5.17
Montrose	4.86	.26	4.35	5.36
Dimock, Springville, Bridgewater, & Brooklyn	5.32	.22	4.88	5.76

Note: **Bold** municipalities are located in NY; *Italicized* municipalities are in PA

This first generalized linear model reveals much more variability in support/opposition in NY than in PA. The municipality means for support/opposition in NY ranged from 2.01 – 4.38

(a difference of 2.37); in PA they ranged from 3.63 – 5.32 (a difference of 1.69). Additionally, the mean for support/opposition in every PA municipality was on the support side of the scale midpoint, whereas six NY municipality means were on the support side while eight were on the oppose side. The most polar municipality in NY (Dryden) differs significantly from twenty-two other communities, including eight communities in NY; the most polar municipality in PA (Dimock, Springville, Bridgewater, & Brooklyn) differs significantly from only thirteen other municipalities, including only two in PA.

B. Model with beliefs about risks as the dependent variable

The second generalized linear model I ran included a composite variable that represented the latent factor "beliefs about risks" as the dependent variable. I created this variable by averaging together the fourteen variables that pooled together on the "risks" factor in Table 6.24. Municipality was not a particularly strong predictor of beliefs about risks. The model had $p < 0.001$ based on the likelihood ratio chi-square test statistic of 80.0, but in terms of pairwise comparisons of estimated marginal means (with sequential Bonferroni corrections for multiple comparisons), Caroline differed from the greatest number of other municipalities, being significantly different from only six. I ran this same generalized linear model, but with just likelihood of risks as the dependent variable (as opposed to likelihood times effect on quality of life); the results changed very little. The same was true of a model that used only effects on quality of life as the dependent variable. The models reveal that beliefs about risks vary less between communities than do summary views of support/opposition.

C. Model with beliefs about benefits as the dependent variable

My third generalized linear model used a dependent variable that was the average of all the variables from the beliefs about "benefits" factor from the factor analysis in Table 6.24. Again, municipality was a moderate predictor of beliefs about benefits, as it was for beliefs about

risks, but not nearly as strong a predictor as it was for support/opposition. The model had $p < 0.001$ based on the likelihood ratio chi-square test statistic of 128.3. Nevertheless, in pairwise comparisons, Caroline and Newfield each differed significantly from the largest number of other municipalities – only eight each.

D. Models with beliefs about ethical considerations as the dependent variables

Like the previous two models, my fourth generalized linear model used an average of several variables as the dependent variable. For each respondent, I averaged the answers to the eight items that pooled together in the factor analysis in Table 6.25. The model revealed that no municipality differed significantly from any other municipality in the pairwise comparisons, using sequential Bonferroni corrections for multiple comparisons. The model had a p-value of 0.188 based on the likelihood ratio chi-square test statistic of 33.3. I checked this generalized linear model against models for each of the eight ethical considerations independently, to see if pooling the variables had led to loss of statistical significance. In none of the eight individual variable models did any municipality differ significantly from any other municipality in the pairwise comparisons of estimated marginal means.

This finding of a near complete lack of variability between municipalities in the importance of various ethical considerations is an important finding for communication about shale gas development. Beliefs about the importance of these ethical considerations for decision making on shale gas development are fairly uniform and uniformly indicate high importance. I discuss the communication and policy implications of this finding further in Chapter Seven.

My fifth and final generalized linear model used beliefs about the ninth ethical consideration from Table 6.3 as the dependent variable, "people's rights to use their property as they want to". While still not exhibiting a great deal of variability, this ethical consideration showed greater difference across municipalities than all eight other ethical considerations, with $p < 0.001$ based on the likelihood ratio chi-square test statistic of 96.7. Caroline differed from the

largest number of other municipalities in the pairwise comparisons – six. Again, the NY municipalities showed more variability (between municipalities) on this representation, compared with the PA municipalities; the NY municipalities' means ranged from 3.97 – 5.43 (a difference of 1.46), while the PA municipalities' means ranged from 4.62 – 5.35 (a difference of 0.73).

VIII. Summary of Findings

In this chapter, I examined evidence that speaks to four research questions. First, I explored what representations of shale gas development exist. The close-ended data revealed that support for / opposition to shale gas development is polarized. Support/opposition varies little regardless of whether the respondent was considering development in his/her community, state, or nation. The impacts considered most likely were social impacts: effects on road quality, an increase in traffic, decrease in peace and quiet, and effects on community character. Similarly, social impacts were also seen to have the greatest effect of any impacts on quality of life, if they were to occur; these impacts included: effects on road quality, an increase in traffic, decrease in peace and quiet, and one environmental impact – decreased water quality. The final close-ended representation was of approaches to regulating shale gas development. Ethical considerations were reported by respondents as highly important for decision making; especially vital were "rights" to clean air and water, preventing harm *at all costs*, and "rights" to use one's property as one desires.

The open-ended data revealed that valence is central to how most respondents represented "shale gas development via hydraulic fracturing". Eighty-two percent of respondents used positive and/or negative language in their open-ended response; many of these valenced statements did not even include an object for the valence – the valence was expressed alone (i.e., shale gas development is simply good or bad). Another major representation of development from the open-ended data was various types of impacts. Effects on water were the

most frequently mentioned impacts, then creation of jobs, and third, production of traffic. As a category, environmental impacts were the most common (39%), with economic (27%) and social (22%) impacts not far behind. Mention of environmental impacts and use of negative language in the open-ended comments associated closely (in the correspondence analyses) with opposition to development. Reference to economic impacts and use of positive language associated closely with support for development. Representations of social impacts and mixed language associated with less polar, more nuanced views on development.

The second research question I investigated in this chapter was the degree to which the manifest representations are actually "social". Descriptive statistics showed that the most used and most useful sources of information for gathering knowledge of shale gas development, according to respondents, were: local newspapers, family and friends, and other community members. This data suggests that much discourse about shale gas development occurs at the local level, in line with assumptions in social representations theory. A generalized linear model revealed substantial variation between communities in support/opposition, particularly for municipalities in NY. In several statistical tests, there was greater variation in representations between municipalities in NY than there was between municipalities in PA. Factors operating at the municipal level, however, appeared to be less relevant for shaping other representations, according to additional generalized linear models (i.e., beliefs about impacts and particularly ethical rationales for regulation on development).

The third research question I considered here, which factors affect social representations, divulged the most interesting results. The strongest empirical relationships between any variables in the survey were between support for / opposition to shale gas development and beliefs about impacts from development. This finding is consistent with previous research on public perceptions of shale gas development. Nevertheless, researchers have previously interpreted this as an indication that beliefs about impacts shape support/opposition. My results, however, provide a strong indication that support/opposition may actually predict beliefs about

impacts (rather than vice versa). Of course, it is possible that feedback loops exist within this relationship, but the data from my survey introduce, at minimum, doubt as to the validity of the typically postulated causal pathway of beliefs about impacts leading to support/opposition.

Given the possibility that support/opposition is antecedent to beliefs about impacts, rather than the reverse, I sought to identify additional variables that might predict the major representation of support for / opposition to development. A range of cultural, structural, historical, and demographic factors predicted support/opposition. The variables most predictive of support/opposition were: (1) the extent to which the respondent believes nature is delicate and easily upset by human actions, (2) whether the respondent had a lease, (3) beliefs about the import of private property rights, (4) the degree to which the respondent is opposed to change in his/her community, (5) political views, (6) visibility of signage in the community about shale gas development, and (7) the degree to which the respondent has had positive experiences with sub-surface resource extraction in the past. Additionally, county-level political views was the single variable measured at the societal level that strongly predicted support/opposition at the community level.

The fourth and final research question I analyzed with the data in this chapter asked how social representations of development relate to support for sustainable and resilient communities. The surprising finding was that increased opposition to development predicts greater support for sustainability, but greater opposition to resilience. Likewise, more support for development leads to opposition to sustainability, but to support for resilience. I offer possible explanations for these relationships in Chapter Seven.

Chapter Seven: Discussion and Implications – Communication and Policy on Shale Gas Development

"Thus, it is easy to see why the representation we have of something is not directly related to our manner of thinking but, conversely, why our manner of thinking, and what we think, depend on such representations, that is on the fact that we have, or have not, a given representation."
-- Serge Moscovici

I. Synthesis and Recommendations

In this chapter I consider what the last three chapters' findings portend for communication and policy on shale gas development via hydraulic fracturing. I first synthesize, across my various studies, the key findings (i.e., what are the major representations of development, what are the main factors influencing representations, to what extent are the representations *social*, and how do representations support sustainable and resilient communities?). Considering the multiple data sources together allows communication and policy recommendations to emerge. Each of the subsequent sections in this chapter offers a major finding, supported by a range of data, that suggests a new way of communicating about or approaching the policy process on shale gas development.

II. Limited Representations

My data revealed that representations of shale gas development are neither diverse nor nuanced. The newspaper content analysis revealed only eight impacts mentioned in more than ten percent of total coverage of "Marcellus Shale" issues across the four newspapers. While I asked about 24 specific impacts in the survey, responses to 20 of these impacts loaded clearly onto two factors ("risks" and "benefits"), suggesting that there was very little differentiation within these categories. The open-ended responses from the survey revealed that, like newspaper coverage, most environmentally-related impacts mentioned were either about water or broad references to "environmental" effects, without any further specification. The economic

impacts mentioned in the open-ended elicitation, as in the newspaper coverage, related primarily to jobs and broad references to economic "growth" or "development".

The correspondence analyses from the newspaper coverage and the survey reveal that representations of impacts associated with shale gas development were limited even further – the vast majority of environmental impacts were negative and economic impacts were positive. While social impacts were least frequently mentioned (of the three impact categories) in the newspaper coverage and in the open-ended questions on the surveys, these impacts were associated with more nuanced and less polarized views on shale gas development. If mentioned with economic impacts, social impacts tended to be positive; if mentioned with environmental impacts, they tended to be negative.

Implications for policy: The dearth of diversity in representations of shale gas development/fracking is problematic because this is a complex issue with the potential to affect humans and natural systems in a host of ways. If only a few potential impacts are being discussed, this could lead to myopic decision making by ignoring or remaining oblivious to a broad collection of variables that could have wide-ranging effects. Policy makers would do well to ensure that they are considering multiple potential effects of shale gas development far beyond those highlighted by their constituents and the media. This advice applies to decision makers at all levels of governance.

Policy makers may also seek to share information about additional effects of shale gas development to substantiate their approach to the policy process, and to highlight that there is much more that needs to considered, beyond water and jobs, when taking action on this issue. First, constituents care about a range of issues and value many effects more than the ones most discussed in public fora. Second, policy makers will create considerably more work for themselves if they need to continually update policies to account for considerations left out in earlier iterations.

NY, PA, and NB specifically could all benefit from increased attention to the vast array of potential effects of shale gas development. In all three jurisdictions, an ample assortment of social impacts receives little public attention. The substantial concerns about procedural justice in NB and NY would not be mitigated completely, but could be lessened if residents witnessed their governments actively considering a range of impacts. Many of the critiques of shale gas development in NY and NB have centered on the government recognizing certain types of impacts while ignoring others.

Implications for communication: Partisans on this issue could also benefit from learning just how limited representations of this issue currently are. People at both ends of the support/opposition spectrum could easily find a host of positive or negative impacts of shale gas development that are almost entirely neglected in public discourse. They could point to the lack of emphasis on these impacts and claim (disingenuously) that this lack of focus is leading people to view shale gas development in an artificially negative or positive light. The claim is disingenuous because there are many positive *and* negative impacts that are currently neglected and because, as I have shown in Chapters Four and Six, and, as I discuss later in this chapter, it seems beliefs about impacts derive *from* support/opposition (as opposed to vice versa).

For people interested in facilitating informed decision making on this issue, it could be particularly useful to research and communicate about social impacts. These were the least mentioned and least polarizing of all effects of shale gas development in the survey. While increased attention to social impacts *could* introduce additional nuance into the conversation about shale gas development and expand the complexity of this issue in some minds, I am not convinced this effect would materialize. Particularly if the predominant causal pathways between support/opposition and beliefs about impacts run *from* support/opposition *to* impacts, additional information about impacts has little chance of decreasing polarization on this issue or of introducing further nuance into support for / opposition to shale gas development.

III. "Soft" Representations

In Chapter Five, substantial data from my interviews illustrated how social topics were the primary representations of shale gas development. The principal issues that my interviewees raised in connection with shale gas development were "soft" impacts (i.e., less quantifiable, less measurable, and more abstract), such as effects of development on: community character, way of life, aesthetics, beauty, and conceptions of "the good life" in a community. It took lengthy one-on-one conversations with people conversant about shale gas development to explain why the issue really mattered to them. The interviews often started with broad comments about protecting the environment/water or creating new job/economic opportunities, but the conversation always shifted away from these simple tagline impacts to other, more foundational issues.

Negative environmental impacts and positive economic impacts are *easy* representations of shale gas development. Social representations exist for a reason, because they allow people to discuss complex issues in a common language. They are heuristics of a sort; they facilitate knowledge and decision making on a topic with reduced cognitive effort. This is one explanation for why water contamination and job creation, for example, are so commonly invoked. Disruption of a desired way of life is a more complex and less tangible effect. Recall that social representations emerge through anchoring and objectification. Whereas economic development can easily be objectified through images of commercial development and new items that added wealth can bring, and whereas environmental destruction can easily be objectified through images of water on fire, dead fish, and children with asthma, the concept of diminished peace of life is less readily objectified; it is an abstract impact that is difficult to concretize.

"Soft" impacts may be less readily proffered for another reason – because people realize they are "soft". I continually put quotation marks around the word "soft" because I realize that in this context it is a somewhat derogatory word. Policy discussions on shale gas development

(e.g., notably from NY State Governor Andrew Cuomo) often assert that decisions about how to regulate shale gas development need to be based on "facts" and "science". That a desired way of life could be forwarded or hampered by development may be a fact, but it does not seem scientific. More likely, effects on community character and way of life are viewed as "emotions". I have often heard claims from both sides of this debate to the effect that "emotions should be checked at the door". It is quite possible that people do not frequently mention publicly the root reasons they care about shale gas development, and they use proxies such as water contamination and job creation instead, due to the perception (conscious or unconscious) that their concerns about way of life are not "scientific".

The Marcellus Shale residents survey provides some indication that social impacts were also important to the survey respondents. While fewer respondents mentioned social impacts than environmental and economic impacts in the open-ended elicitation, predominantly social impacts had the highest average scores on the questions measuring beliefs about impact likelihood and impact effect on quality of life. If we construct perceptions of risk and benefit from impact likelihood times impact effect, five of the six most important impacts were social impacts (i.e., increased traffic, worse road quality, decreased peace and quiet, change in community character, and decreased local beauty; the other impact was decreased water quality).

Implications for policy: The interviews and the survey suggest that beliefs about social impacts are crucial representations. As such, I recommend that policy makers give more recognition to social impacts, both in terms of research on the types and magnitude of social impacts that shale gas could engender and in terms of recognizing the importance of less quantifiable impacts. To ignore a diminished or heightened quality of life simply because it cannot be measured in dollars or parts per million is bad policy. If indeed a stigma exists against discussing social impacts as legitimate rationales for caring about shale gas development, policy makers can lessen the stigma by explaining why "soft" social impacts matter. Doing so would show that they are attuned to interests and concerns of their constituents.

I have yet to find a governmental jurisdiction in which focus on social impacts has been more than minimal. Pennsylvania has given some attention to social impacts, but most of this attention was through discussion of an impact fee that could be used to address "community impacts", irrespective of what those impacts are. While it makes sense that additional funds could be helpful for effects on road quality, throwing money at "community impacts" (vaguely defined) seems to misunderstand the character of many of the impacts discussed by my interviewees and the impacts selected as important in the survey.

One component of social impacts associated with shale gas development is effects on public health. New York and New Brunswick have given substantial attention to public health impacts, through the NB Chief Medical Officer's Report and the ongoing NY health impacts review. Additionally, New York's "Revised Draft Supplemental Generic Environmental Impacts Statement (SGEIS) on the Oil, Gas, and Solution Mining Regulatory Program" included specific sections on visual impacts (26 pages), noise (11 pages), transportation (16 pages), and community character (3 pages) (NY DEC 2011). Brief sub-sections in other sections were dedicated to housing availability and environmental justice. While acknowledging community character impacts is certainly a step forward, three pages of rather broad musings on possible changes within a community as part of a 346-page section on impacts indicates that community character impacts (the least quantifiable of all the impacts in the NY SGEIS) are little more than an afterthought.

Canada, as a nation, has appropriately acknowledged the social impacts of shale gas development. A 2014 report from the Council of Canadian Academies states,

> Psychosocial impacts on individuals and on the communities have been reported related to physical stressors, such as noise, and perceived lack of trustworthiness of the industry and government. If shale gas development expands, risks to quality of life and well-being in some communities may become significant due to the combination of diverse factors related to land use, water quality, air quality, and loss of rural serenity, among others (p. xv).

This level of recognition of social impacts is the best that I could find in any government-sanctioned impact assessment. Furthermore, the document goes on to discuss "public acceptability", where it includes the assertion,

> The potential impacts of shale gas development, as well as strategies to manage these impacts, need to be considered in the context of local concerns and values. More specifically, the manner in which residents are engaged in decisions concerning shale gas development will be an important determinant of their acceptance or rejection of this development (p. xvi).

Nevertheless, these considerations are included almost as parenthetical comments in a report whose primary purpose is to highlight environmental impacts. Like the NY DEC SGEIS, which was written by an environmental agency, this document was commissioned by the federal Minister of the Environment. The Canadian report contains 37 pages on water quality impacts, 36 on air quality impacts, and 13 pages on human health impacts. While the report specifies that human health includes "cultural [factors] (e.g., attachment to specific geographical locations)", community disruption and quality of life issues comprise only three pages within the health impacts section. The report also includes explicit attention to "ethical issues", but this section of the report is only three sentences.

Reviewing attention to social impacts beyond my study sites, one can see that almost no attention is afforded in some jurisdictions. The 2014 Impact Statement on shale gas development issued by the European Commission includes a section on "social impacts", but that section begins with the statement, "The main social impacts stemming from the policy initiative [on shale gas development] are likely to be linked to jobs opportunities (in the shale gas sectors and in related sectors), to health issues (for the workers and the general population) and to the price of energy for final consumers" (p. 64). Two of these impacts are predominantly economic in character and none relate to the way of life issues highlighted as most important in my interviews or survey. As a final example, in the UK, the Royal Society's 2012 report, "Shale gas extraction in the UK: A review of hydraulic fracturing" includes no reference to effects on way of life or community character and well-being.

Implications for communication: Communication about shale gas development/fracking ignores almost entirely the "soft" representations I highlight here. This presents an opportunity for policy makers, journalists, and partisans on all sides of this issue. To the extent that what people really care about in relation to shale gas development is effects on beauty, peace and quiet, returning a community to a previous state of vitality, and/or preserving or fostering "the good life", communication may be able to reach audiences in powerful ways by speaking to these issues (as opposed to impacts alone). Of course, this would require knowing what conceptions of "the good life" are sought in various communities, and amongst different audiences.

Another common representation of development that emerged in the interviews was the tendency to label people opposed to one's own point of view as greedy and self-centered, while depicting one's personal perspective as community-minded. For partisans on this issue who truly believe their views are community-minded, they could do well to articulate cogently why their approach to shale gas development benefits the community and to communicate lucidly this information. It would help, however, to view their "community" less myopically than only those individuals who share their point of view.

IV. Ethical Representations

Ethical rationales for regulating development are also neglected in public discourse, but were prominent in my interviews. Furthermore, ethical approaches to regulating development were repeatedly cited as important in my survey. Neither the importance of ethical rationales for decision making on shale gas development nor their neglect in policy making is surprising.

While discussing the purpose of social representations and the processes by which social representations emerge, Serge Moscovici wrote, "Whoever keeps his ears pinned back in those places where people converse, whoever reads interviews with some attention, will realise that most conversations are about highly 'metaphysical' problems – birth, death, injustice, etc. – and

about society's ethical laws" (1984b, 21). Therefore, the relevance of the aforementioned "soft" social impacts and of ethical considerations is predictable. Why then are ethical rationales for decision making not discussed much in public fora, particularly in the realm of public policy? Perhaps for the same reason I postulated that effects on way of life are rarely discussed – they seem "unscientific" and seem to be based on "emotions", not "facts".

There may also exist an assumption, in the minds of some, of how policy making *should* occur; therefore, no discussion of approaches to decision making is required. Some of the policy discourse on shale gas development, particularly in academic communities, seems to stem from the *assumption* that weighing impacts (risks and benefits) is the appropriate approach to forming policy. Comments such as "let the science decide" also invoke this brand of reasoning. While knowing something about effects of shale gas development is essential for constructing good policy, factors beyond a strict weighing of risks and benefits are also relevant for generating policy.

My interviewees and survey respondents certainly found other factors essential to good policy. One of the most common representations of shale gas development in my interviews related to procedural justice (notably, the lack of it). Some interviewees from New Brunswick stated that even if they were certain no negative impacts would accrue from development, they would still oppose it due to what they viewed as a secretive, rigged, and unfair process by which regulation occurred. Procedural justice concerns were also the most common normative representation in newspaper coverage on shale gas development in NY. Distributive justice concerns – concerns about *who* benefits and *who* is harmed – were notable in PA newspaper coverage and in PA interviews.

All nine ethical representations that I included in the survey had average values between "important" and "extremely important". When asked to indicate which ethical consideration they found most important, the greatest percentage of respondents selected "rights to clean air

and water", "preventing harm *at all costs*", and "people's rights to use their property as they want to".

Implications for policy: Just because someone says that he/she values a particular approach to regulating shale gas development does not mean that policy makers need to adopt that approach. Nonetheless, if a number of citizens think that certain rationales for governing development are important, policy makers should at least consider those approaches and then communicate to the public why they have chosen to regulate development according to their adopted method. Policy makers ignore at their own peril public perceptions of what constitutes a fair and just process for decision making.

In none of the jurisdictions I examined herein (NY, PA, or NB) has any public effort been made toward including ethical discussions in policy formation. NY has, perhaps, gone most explicitly in the opposite direction, with its Governor, Andrew Cuomo, asserting that policy decisions on this issue need to based in "sound science". While 'sound science' is essential for effective policy development, so is 'sound moral thought/ethical reasoning'. For policy makers, this suggests it could be valuable to create public fora for discussing ethics as they relate to shale gas development, and to include a role for philosophers, ethicists, and, broadly, for the process of moral/ethical analysis in creating regulation on shale gas development. Policy makers must recognize that 'sound science' (i.e., empirical data) alone cannot foster useful policy recommendations. "Let the science decide" is empty rhetoric here. Deciding, for example, (1) how much weight to give distributive justice considerations, (2) whether and how to apply the "precautionary principle", and (3) what should be the appropriate level of citizen involvement in decision making requires ethical and value judgments.

For scientists, journalists, and anyone offering recommendations for how to regulate shale gas development, the importance of sound moral thought/ethical reasoning is a call to acknowledge normative claims in their writing (thus, avoiding cryptonormativism), and to justify their normative approach(es). Particularly for scientists who champion the value of sound

science for decision making, these researchers should distinguish better between their scientific results and their normative claims. Not doing so could diminish the credibility and value of their empirical data.

For educators, the importance of sound moral thought/ethical reasoning for decision making means that we must provide our students, or the public we serve, with more than a scientific awareness of the physical, biological, social, and economic phenomena associated with shale gas development. We must teach them ethical tools for thinking about how regulation *should* occur. This applies to educators in K-12, college/university, adult education, and extension/outreach settings. Educators who do not have expertise in moral thought can solicit experts externally to teach these skills. University cooperative extension and outreach educators frequently rely on outside experts to provide specialized knowledge.

Implications for communication: Other parties, beyond policy makers, may also wish to use ethical representations to communicate about shale gas development. The ethical representations had the least variation across municipalities of any representation I measured in the survey. Respondents answered that all of the ethical considerations were important for regulating shale gas development and they were relatively equally important in NY, PA, and all of the counties and municipalities within those states. Discussing shale gas development and governance of development in terms of these ethical representations, as opposed to discussing highly polarizing impacts such as job creation and water contamination, could be a valuable way to approach this topic, particularly if conversing with audiences of a different persuasion than your own, or with audiences of mixed perspectives on development.

V. Historically-, Culturally-, and Socially-dependent Representations

In answering my research question of which factors most influence representations of shale gas development, I found that history within a community/region, various cultural values,

and aspects of the social structure affected representations – particularly support for / opposition to development.

The journalists I interviewed mentioned hearing residents commonly connect local history of resource extraction with representations of shale gas development (e.g., coal around Scranton). Likewise, such history was important for my PA interviewees (timber and coal) and my NB interviewees (timber). History of extraction also emerged as important for explaining support / opposition in the linear regression and structural equation models for the survey data. While "cultural values" covers a broad swath of potential factors, ranging from the aforementioned ethical considerations to beliefs about community character and way of life, this category of factors also includes specific values that I operationalized in the survey. The regression and structural equation model revealed that beliefs about the balance of nature being delicate, about people appreciating their community "as is", and about acknowledging the value of private property rights all predicted support/opposition.

In my interviews with the journalists and the key informants in NY, PA, and NB, several people mentioned structural factors that seemed to affect their representations of development, such as the economic status of the community, the potential for development locally, previous behavior by industry in the community, and the regulatory role afforded to municipal governments. Even small visual reminders of the shale gas development debate, such as the presence of signs supporting or opposing development in local communities, were important for shaping representations (revealed in the regression and SEM for the survey data).

Implications for policy: Policy construction that does not acknowledge powerful differences between communities could meet with strong resistance. A June 2014 ruling by the NY Court of Appeals set legal precedent for municipalities to use "home rule" to zone shale gas development into certain areas. The opportunity for governance at the local level will make it easier for regulation in NY to account for aspects of historical, cultural, social, and physical context that shape representations. Likewise, in late 2013, the Pennsylvania State Supreme

Court found provisions of the 2012 "Act 13" (a bill with omnibus amendments related to oil and gas) to violate the Commonwealth constitution. The unconstitutional provisions sought to restrict local zoning of shale gas development.

While laws in NY and PA now recognize the ability of municipalities to regulate development, this is not the only effective way to acknowledge contextual differences between communities. In many jurisdictions (e.g., New Brunswick [Canada], the UK, The Netherlands, and other European nations currently contemplating shale gas development) it is still unclear whether and/or to what extent local municipalities will be able to regulate shale gas development. If municipalities are not afforded a role in such regulation, or if the role is minimal, policy makers would benefit from assuring that deliberations on the state/provincial, national, and international levels account for local considerations. This is reminiscent of a recommendation from the "soft" representations section (above). In impact assessments at all levels, the government officials responsible for commissioning or overseeing those assessments should ensure that historical, cultural, and social structural aspects of context are included in the analysis. For example, aspects of local context could be considered in a way similar to how variation in local environmental conditions is accounted for in environmental impact statements. To properly include these variables, more research will needed than the cursory assessment of community level factors given to date in any of the impacts assessments I reviewed.

Implications for communication: Most of the foregoing influences on representations of shale gas development (particularly on support/opposition) suggest that communication seeking to influence representations will be more challenging than if representations of support / opposition derived primarily from beliefs about impacts (i.e., the commonly-held view). The main factors shaping support/opposition are not knowledge-dependent; they form a set of variables for which change occurs more slowly and arduously. They do, however, suggest approaches to communicating about shale gas development (with the goal of transforming representations) that could meet with success. For example, because we know that the history of

resource extraction locally is important to representations, one could communicate explicitly about why shale gas development is similar to or different from previous resource development. Partisans on this issue should recognize, however, that in some communities different interviewees viewed the same shared history as extremely positive and extremely negative. People communicating about historical experience will want to know the valence(s) assigned to that historical experience by their audience.

Social structural factors such as signs within a community portend opportunities for social influence through grassroots campaigns. Cultural values, on the other hand, are notoriously formidable when one seeks to change representations; nevertheless, one may not need to change a cultural value. Rather, he/she might seek to change the way in which shale gas development is perceived as relating to that cultural value. For example, for an audience of people who like their community "as is" and desire no change, communicators may wish to focus on how shale gas development promotes or harms/destroys the important elements that exist in the community. Policy makers could communicate how regulating the pace and scale of development would allow for development that does not change the fundamental character, peace, or beauty of the community.

I discussed briefly the import of private property rights in the section on ethical representations (above). To deal with this cultural value, the extent to which private property rights are relevant to regulation of shale gas development needs to actually be discussed (rather than simply asserted or dismissed as is often the case today). Communicators on all sides of the issue should acknowledge the importance of private property rights and then explain why they are or are not germane to governance of *this* issue. For example, is shale gas development actually akin to using land in other ways that are currently allowed, or is it more similar to land uses that are currently tightly regulated?

The final cultural value that had a strong influence on support/opposition was respondents' beliefs about the delicateness of the balance of nature. Perhaps an influential

means of communicating could be to focus on nature's ability to cope with the potential effects that development could bring, rather than simply trying to convince an audience that a certain type and level of damage will occur.

VI. Unexpectedly Divergent Representations

Although much scholarly research would predict otherwise, the concepts of sustainability and resilience drew divergent representations from my survey respondents. The more one supports shale gas development, the more likely one is to think that resilience is important for the future of his/her community. The more one opposes shale gas development, the more likely one is to think that sustainability is important for the future of his/her community. In spite of this finding, each of the six factors that comprised both "sustainability" and "resilience" were considered relatively important by a large majority of respondents. The six variables all received average values between "important" and "extremely important". Nevertheless, each of the sustainability items had higher mean values than the resilience items.

These findings connote that (1) most of the randomly-sampled respondents to the survey in the Marcellus Shale region believe that sustainability *and* resilience are important to the future of their community, but (2) the more respondents support shale gas development, the more likely they are to think resilience is important and the less likely they are to think sustainability is important. Similarly, the more highly respondents oppose shale gas development, the more likely they are to think sustainability is important and the less likely they are to think resilience is important. This initially surprising findings is intelligible in light of one major factor affecting support for / opposition to shale gas development – the propensity to not want one's community to change, but to remain "as is". Sustainability is inherently more conservative than resilience in the sense that "considering future consequences" and "understanding tipping points" would likely prevent change to a greater degree than "being a community that can reinvent itself" and

"being able to absorb and adapt to change" would. (These four statements were factor variables that measured the two respective latent constructs.)

Implications for policy: Both sustainability and resilience are frequently cited as important for policy, particularly for policy on issues with complex environmental, economic, and social implications. The survey results advise that policy constructed to promote sustainability and/or resilience could be well-received. My interviews, however, suggest that the words "resilience" and (particularly) "sustainability" should not be used (due to additional cultural baggage attached to these words); rather, the concepts, as presented in Table 6.8, should be communicated. Particularly in areas where sentiment on this issue is split, policy makers might consider regulation that addresses components of sustainability *and* resilience.

Implications for communication: When communicating with audiences opposed to shale gas development and seeking to elicit support for policies that permit some development, using the concepts of sustainability (although not necessarily the word "sustainability" itself) for discussing how to move forward on the topic of development would be advantageous. When communicating with audiences supportive of shale gas development and seeking to elicit caution and concern about development, using the concepts of resilience (although not necessarily the word "resilience" itself) to discuss development would be opportune. In both cases, using the concepts of sustainability or resilience could help one gain a common representation around which to frame discussion of this issue with an audience that might otherwise be opposed to one's perspective. Partisans on any side of this issue or people simply interested in forwarding the policy process could benefit from this finding.

People opposed to development could try to explain to people in favor of it why they believe development does not improve community resilience. Alternatively, they may choose to avoid the contentious topic of development and seek to explain other actions their community/region/state can take to increase resilience – seeking to reveal that shale gas development is not the only option. Likewise, those supporting development could try to

illustrate why they believe development does not harm community sustainability. In both cases, acknowledging the importance of resilience or sustainability (whichever concept is more relevant to the audience) could be an important first step to approaching a conversation with parties opposed to one's own view on development.

VII. *Social* Representations

This section's heading might seem confusing. Have I not been discussing social representations all along? Yes, but here I explicitly consider the evidence that accumulated across the content analysis, interviews, and survey for the extent to which representations were social; I then discuss the implications of this for policy and communication about shale gas development. Serge Moscovici (1984b, 8) offers a compelling theoretical rationale for why social representations are indeed social:

> Nobody's mind is free from the effects of the prior conditioning which is imposed by his representations, language and culture. We think, by means of a language; we organize our thoughts, in accordance with a system which is conditioned, both by our representations and by our culture. We see only that which underlying conventions allow us to see, and we remain unaware of these conventions.

Moscovici helps us understand the social forces that condition representations, but he also acknowledges that individual cognitions and expressions can contribute to the evolution of social representations over time. The question then becomes a more nuanced one, not of *whether* representations are generated in the public sphere by societal-level forces, but rather the *degree to which* representations emerge in this way.

The question about derivation of social representations is even more complicated. Many of the factors leading to emergence of social representations that I discuss in Chapter Two (e.g., complex scientific character of the object/process/idea, unknown nature of the new item being represented, contentiousness of the item, related items and images available for anchoring / objectification, etc.) illustrate that the degree to which representations are social could vary substantially based on the specific object, process, or idea being represented.

Each of the journalists I interviewed emphasized that public discourse on the local level was his/her primary information source for reporting on shale gas development in the Marcellus Shale region. My survey of residents in this region disclosed that local newspapers are the most consulted information source on this topic. In combination, these findings provide a strong indication that at least in an area close to development, local discourse is informing representations – lending those representations a social character.

Additionally, my analysis of sources cited in the newspaper articles revealed substantial differences between the NY and PA newspapers in the frequency with which certain groups were mentioned. For example, landowner groups, anti-fracking groups, and non-profit groups were mentioned much more in the NY papers. More of these groups are active in NY than in PA, providing a structural reason for this local variation in sources, which then shapes discourse, leading to a different range of representations presented across the states.

In NB, while I did not survey residents there, I would be shocked if local newspapers were used to the same degree to learn about this issue as in NY and PA. My interviews divulged that lack of trust in print media and perceptions of a hostile media effect in NB led other information sources to be consulted more regularly. Word of mouth was very important there, as was the Internet. Internet may or may not reveal a social character to representations. To the extent that people share information via e-mail and listserves (something mentioned in several interviews), representations likely are social. To the extent that people are conducting Google searches, their representations of development are less shaped by public discourse operating on the local level.

The stark differences that emerged between the NY, PA, and NB communities in which representations were highlighted most prominently also affords support for representations of this issue being social. People from all communities offered, for example, effects on beauty/peace/quiet, claims of misinformation, and beliefs about self-interest vs. community-mindedness as representations of shale gas development. Nevertheless, other representations

were unique to specific communities or jurisdictions. Procedural justice was a much more notable representation in NB, compared with NY and PA, likely due to governance in that province.

Polarization of shale gas development/fracking was substantial in every community, save Richibucto, where residents indicated that prospective development actually drew the community together. History of development anchored representations in many communities, but the anchor varied widely, from experience with coal in Scranton, to lumbering in Doaktown, to environmental contamination from the Potash mine in Sussex, to conventional oil and gas development in Van Etten. The most salient representations related to shale gas development varied across communities due to contextual differences on the local level.

The NY journalists I spoke with hypothesized that variation in regulation of shale gas development between NY and PA, and the respective stage of each state in the regulatory process, fostered different representations of shale gas development. The substantial differences in support/opposition between the states and the much larger variation in support/opposition in NY corroborate the journalists' contention that representations differ between states and that they are more polarized in NY. My interviews in NB consistently revealed the import of the regulatory process for shaping representations in that province (particularly a perceived lack of fairness, but also government ownership of mineral rights as "crown" resources).

Implications for policy: Taken together, the foregoing findings reveal that some representations of shale gas development seem to be shared across communities and governmental jurisdictions while local discourse shapes others. Local discourse derives from social structure, cultural values, historical experiences, and governmental frameworks. Returning to a recommendation from the "soft" representations section and from the historically-, culturally-, and socially-dependent representations section, the strong *social* character of many representations suggests that policy needs to account for factors operative on the local level. This could mean that policy should occur at the local level, or it could mean that if policy occurs

at other levels, substantial research needs to be conducted to understand the ways in which development is represented contrastingly in different areas.

Policy makers who do not account for the *social* nature of social representations could anger and alienate more of their constituents than they would if they recognized variations in representations and the reasons the representations vary. Some proposed policies, such as NY Governor Andrew Cuomo's suggestion that development be permitted in some areas of NY but not it others, while criticized by various groups, is an example of a policy that attempted to conform regulation to the *social* character of representations. Quite obviously, no regulation will please all constituents on this contentious issue, but by understanding the social nature of representations, policy makers can at least: (1) acknowledge the various factors shaping representations in different areas, (2) recognize the import of those factors, and (3) communicate how they think their policies address the salient representations across communities/regions. This approach is better than leaving constituents to claim that their representations of the issue were neither acknowledged nor actively considered in the decision making process. Such efforts could at least address some of the procedural justice concerns waged by NB and NY interviewees and mentioned in the NY newspapers. Awareness of the social nature of representations and the variations in representations across contexts, and the use of this information to tailor policy approaches, might not improve trust in government, but it could prevent further degradation of trust.

Implications for communication: Some representations of development depend substantially on local context and social discourse, while others are consistent across communities, jurisdictions, and scales of analysis. This suggests that when communicating with large audiences from a range of areas, focusing on the broadly shared representations could be most useful. It also means that when communicating with audiences on a more local level, the communicator needs to be aware of the particular ways in which that community has represented development. While this sounds like an arduous task, one could probably learn a good deal

about the dominant representations in a community by reading a few local newspaper articles and chatting with local residents in public settings, such as the diner, post office, café, general store, and/or bar. Acknowledging an awareness of the way this issue is represented locally could do much to establish or increase credibility in the eyes of a potential audience.

VIII. Valenced Representations

I consider this my most important finding. Unlike what most researchers studying public perceptions of shale gas development have claimed or implied, my data portrays support for / opposition to development (i.e., summary representations of valence) *leading to* beliefs about impacts. Many scholars have suggested the reverse is true. I have not seen any evidence to verify the directionality of the commonly-asserted pathway, save the (somewhat logical) assumption that one would judge the goodness or badness – the desirability or undesirability of something – based on the consequences that the object or process would engender. Nonetheless, if we return to Moscovici's quote that introduces this chapter, we realize social representations theory is not consistent with this logic. He contends that representations *precede* our individualized thinking about an issue, rather than our thinking leading to the representations. This conclusion makes sense if we accept that representations are based on history, culture, social structure, political governance, and the discourse/language that each of these elements foments. Throughout this dissertation, I have offered evidence that this is the case.

A. Empirical evidence

The factor analyses in Chapter Six reveal that the vast majority of beliefs about the impacts measured in the survey seem to represent only two constructs – "positive" and "negative" effects – "risks" and "benefits". If survey respondents treat as a single construct a large group of negative effects and treat as a separate sole construct a large group of positive effects, this offers strong evidence for those individuals determining the likelihood of an effect

occurring, and determining the effect's impact on quality of life, based on whether the effect is good or bad. This means that they have decided on the valence of shale gas development before forming beliefs about the impacts of development.

A rather different set of statistical analyses, which further substantiates my conjecture about the casual pathways, is the structural equation models for the survey. They reveal that the model with the causal pathways going from support / opposition to beliefs about impacts exhibits better model fit, across numerous fit indices, compared with the same model, but in which those pathways were reversed. I must note that I have never claimed and do not claim here that the findings from the factor analyses, the replication of those factor analysis findings in the structural equation model, or the comparisons of structural equation models *prove* the causal links that I hypothesize. Bollen and Pearl (2013) explain,

> Failure to fit the data [in a structural equation model] casts doubt on the strong causal assumptions of zero coefficients or zero covariances and guides the researcher to diagnose, or repair the structural misspecifications. Fitting the data does not 'prove' the causal assumptions, but it makes them tentatively more plausible.

All I claim, from my empirical findings, is that my explanation for the causal pathways is "tentatively more plausible" than supposing that they exist in the reverse direction. I also note that my results "cast doubt on the strong causal assumptions" forwarded by other researchers.

B. Theoretical support beyond social representations theory

While social representations theory would have, over half a century ago, predicted the causal pathways I hypothesize, other more recently emergent theoretical traditions justify further the contention that support/opposition primarily causes beliefs about impacts (rather than vice versa). For example, research on motivated reasoning contends that particularly on partisan issues, people will often form beliefs about facts based on the facts' consistency with their opinion on the issue. Druckman (2012, 200) defines motivated reasoning as:

> the tendency to seek out information that confirms priors (i.e., a confirmation bias), to view evidence consistent with prior opinions as stronger (i.e., a prior-attitude effect), and to spend more time counterarguing and dismissing evidence inconsistent with prior opinions, regardless of their objective accuracy (i.e., a disconfirmation bias).

I did not focus my research on information seeking or the ways in which people handled evidence; therefore, I will not make any claims about the extent to which motivated reasoning applies to the issue of shale gas development. I will note, however, that the research literature on motivated reasoning would predict the causal pathways that I have identified (see, for example, Myers *et al.* 2013). Neurobiological (Westen *et al.* 2006) and experimental psychological studies (Boiney *et al.* 1997, Dawson *et al.* 2002) offer evidence consistent with the existence of motivated reasoning.

The cultural cognition thesis further substantiates the direction of causal pathways I hypothesize. Kahan and colleagues (2011, 148) explain that "cultural cognition refers to the tendency of individuals to fit their perceptions of risk and related factual beliefs to their shared moral evaluations of putatively dangerous activities." Therefore, this theory fits even more closely with my findings in that it asserts views of good/bad, right/wrong precede risk perceptions and factual beliefs (as does motivated reasoning), but it also includes the stipulation that the evaluations of valence are "shared" (as does social representations theory). Kahan and Braman (2006, 150) also postulate,

> Essentially, cultural commitments are prior to factual beliefs on highly charged political issues. Culture is prior to facts, moreover, not just in the evaluative sense that citizens might care more about how gun control, the death penalty, environmental regulation and the like cohere with their cultural values than they care about the consequences of those policies. Rather, culture is prior to facts in the cognitive sense that what citizens believe about the empirical consequences of those policies *derives* from their cultural worldviews.

At first blush, one might think that the foregoing quote was written by Moscovici in the 1960s, as opposed to by two completely unconnected lawyers/psychologists four decades later. Like social representations theory, the cultural cognition thesis maintains that cultural forces shape beliefs about impacts (rather than vice versa) and it highlights the particular strength of

this relationship for contentious issues. The cultural cognition thesis differs from social representations theory, however, in that it supposes the causal pathways to exist as they do because of "overlapping psychological mechanisms" (Kahan and Braman 2006, 150). In this way, the cultural cognition thesis is analogous to motivated reasoning, which also identifies psychological mechanisms as the sole explanation for the directionality of the causal pathways, and dissimilar from social representations theory, which leaves room for social *and* individual-level influences – postulating the primacy of the former. It is confusing that the cultural cognition thesis does not account for societal-level factors when "shared evaluations" and culture (which is, by definition not an individual-level construct) are so central to the concept. Swanson (2010) offers this same critique by highlighting the substantial role that social factors can play in shaping worldviews.

In addition to the empirical evidence reviewed above and the theoretical support for my hypothesis that comes from social representations theory, research on motivated reasoning, and the cultural cognition thesis, the pathways that I have specified are intuitive to me as a researcher who has spent the last four years deeply engrained in discourse on shale gas development. A constant refrain has been hearing people tell me how bad or good shale gas development is (actually, they generally say "fracking"); they *then* ask me to explain the impacts to them. It seems much more instinctive that people are *not* hearing about fracking/shale gas development and then deciding that it is fantastic or horrible, rather, they are hearing about something fantastic or horrible and then associating that valence with "fracking" or "shale gas".

It is unlikely in today's society, at least in areas where this issue is regularly discussed, to experience a conversation about fracking/shale gas development that is unassociated with valence. Many conversations are dominated by valence. I have given numerous presentations on my research (which generally focus on the need to approach this issue with nuance and to consider the host of factors influencing representations). Often the first question I receive at the end of the presentation is something to the effect, "Okay, but how do *you* feel about fracking?" I

do not think these people mean for their question to be as ironic as it sounds based on the topic of my presentation.

The audience member, whether in an academic or public gathering, simply wants to know my valence on the issue. People regularly express that they believe I am lying or hiding something when I profess that I neither support nor oppose shale gas development/fracking. This incredulity is easily understood if we accept that fracking/shale gas development (as an object to be represented), before being a technical process or series of impacts, is simply "positive" or "negative". By stating that I neither support nor oppose it, I am refusing to enter into what I have identified in this dissertation as the primary representation of fracking/shale gas development. As I quoted Moscovici previously, "We see only that which underlying conventions allow us to see, and we remain unaware of these conventions." Valence is, for many, a necessary component of any representation of fracking/shale gas development.

I do not wish to assert my point too strongly. Valence may not be a necessary component of representations in every instance in which fracking/shale gas development is discussed. My survey and interviews sampled from populations in areas heavily exposed to discourse on this issue. I have pointed to the importance of context specificity throughout this dissertation. The importance of valence and the stage in the evolution of the representation in which valence enters could vary across communities, regions, states/provinces, and nations.

Implications for policy: If policy makers wish to address their constituents' concerns and interests, they will need to craft policy that responds to far more than simply the set of impacts potentially associated with shale gas development. Impacts are still important, and "facts" of what effects will likely occur from shale gas development are an essential – but insufficient – component of any policy decision. Policy makers would be able to respond better to the needs and interests of their constituents if they knew the root rationales for why people hold the valences that they do in relation to shale gas development/fracking.

My research and social representations theory suggest that a number of historical, social structural, cultural, and political governance factors influence valences. Cultural cognition submits that worldviews such as the degree to which one is "hierarchical" vs. "egalitarian" and "individualistic" vs. "communitarian" minded could explain much of the variance in valenced representations (Kahan *et al*. 2009, Kahan *et al*. 2011). Motivated reasoning offers that once a position on an issue is formed, psychological heuristics will help prevent that representation from shifting too much (similar to "anchoring" from social representations theory). The extent to which individual-level factors (psychological / American social-psychological) and/or societal-level factors (sociological / European social-psychological) shape representations has relevance to policy construction. Motivated reasoning and cultural cognition assume that individual-level processes are the main (if not sole) forces affecting the presence or absence of cognitive thought about shale gas development. Social representations theory would ascribe primacy to societal-level forces.

The tension between societal-level and individual-level factors, however, need not imply that one theory is correct and the other is not; they each may contain partial truths. Motivated reasoning and cultural cognition assert that people build psychological defenses, of a sort, against considering information that is contrary to their point of view. Social representations theory can work with these other theories to explain why people are prompted (sub-consciously) to form these defenses. The character of the representation that emerges through social discourse can explain the proclivity to engage in motivated reasoning or to access certain worldviews in line with cultural cognition.

Policy makers may be interested in encouraging citizens to consider the issue of shale gas development/fracking more cognitively. The policy maker can use knowledge of the factors leading to the valenced representations to target ways to work around the cognitive biases individuals employ on the topic of shale gas development. For example, as I noted in the section on historically-, culturally-, and socially-dependent representations, explicit consideration and

acknowledgement of how a proposed policy accounts for relevant historical experience and cultural values would likely have a greater potential effect on valenced representations of shale gas development compared with a policy than only discusses impacts. Policy makers working on shale gas development/fracking are fond of "impact assessments". If policy is to move forward on this issue, the ultimate factors that affect beliefs about those impacts need to receive greater attention.

Implications for communication: The hypothesis that support for / opposition to shale gas development leads to beliefs about impacts implies that communication about this issue will be more difficult than both academics and the public have asserted. A logical conclusion from research that suggests knowledge about impacts *leads to* support / opposition is that additional knowledge could help shift support/opposition more in line with "reality". This is akin to the information deficit model of communication, which Baruch Fischhoff (1995, 138) critiqued by likening it to the simplistic sentiment that in order to communicate risk effectively, "all we have to do is tell them the numbers". This approach to communication, shown to be insufficient for at least two decades, also seems to be the assumption of the numerous interviewees who expressed to me that people on the other side of the issue are simply "misinformed", and that with additional information, these people opposed to their position would, of course, see the issue from an entirely new point of view. My research proffers that these assumptions are wrong and naïvely optimistic, at least in communities exposed to substantial discourse on this issue. Speaking of the implications of valenced representations leading to beliefs about impacts, Kahan and colleagues (2011, 169) write, "To overcome this effect, communicators must attend to the cultural meaning as well as the scientific content of information." This corresponds with my many assertions about the need to communicate about the factors I identified as leading to support/opposition.

While I maintain that communication about impacts will not meaningfully change valenced representations, I must note that I am referring primarily to specific measureable

impacts. One of the factors that I do believe affects valenced representations of shale gas development is whether residents value their community "as is", or would like to see change. Therefore, the extent to which development could bring change to their community might affect valenced representations. This, however, is not a belief about a specific change, but belief about change in general (or, perhaps, beliefs about an amorphous aggregation of multiple impacts). It is entirely plausible that the possibility of change leads to support/opposition, while support/opposition leads to beliefs about the likelihood, and effect on quality of life, of *specific* changes. Communication might do better to focus on a broad discussion of the way of life in a community (e.g., will the community change in meaningful ways, will it stay the same in terms of its essential character?) than to focus on specific impacts.

Implications for research: I have included this additional section here due to the tendency of research on public perceptions of shale gas development/fracking to either: (1) explicitly contend that beliefs about impacts predict overall valenced sentiments (e.g., support for / opposition to development) or (2) implicitly assume that studying impacts will help explain why people care about this issue. Kriesky and colleagues (2013, 233) are the most forthcoming – they state explicitly that their regressions reveal that (1) support for shale gas development is "due to" perception of economic impacts and possession of a lease and (2) their correlational results identify "concern for environmental and public health impacts" as "contributing to opposition". Jacquet and Stedman (2013, 463) assert that impact perception "explains" overall attitude (positive or negative) to gas drilling. Theodori (2013) uses beliefs about impacts as independent variables in regressions to predict civic actions taken on the issue of shale gas development. Theodori (2009) examines perceptions of whether thirty impacts are getting better or worse, with the assumption that beliefs about impacts are evaluated individually.

Wynveen (2011), Ladd (2013), and Braiser and colleagues (2011) all present research from interviews that focus on perceptions of impacts. While none of these research articles state that perceptions of impacts lead to summary evaluations of shale gas development, their focus on

perceptions of impacts as the central research construct at least implies an assumption that impacts are important for determining some perspective on development. Schafft and colleagues (2013, 143) describe research that reveals an "association" between beliefs about impacts and several other variables. In a departure from the approaches of other researchers, they treat beliefs about impacts as the dependent variable in their regressions. Nevertheless, there is no summary measure of valenced representations (e.g., support/opposition) in their model, and their assumption is, similar to the interview research, that perceptions of impacts matter for better understanding people's views on shale gas development.

Based on the findings in this dissertation, the heavy focus on perceptions of impacts/ risks/benefits in social-psychological research on shale gas development is concerning. In the same way that valenced representations are the primary means by which the general public characterize shale gas development/fracking, beliefs about impacts seem to be the representation of this issue used by social-psychologists. I do not know why the focus on impacts is so intense in this research literature; perhaps it has something to do with the focus on impacts in the boomtown literature from the 1970s, which in many ways has served as a precursor to research on public perceptions of shale gas development. Regardless of the reason for the focus, if social-psychological research on perceptions/representations of development is to move forward, it needs to examine more critically the role that beliefs about impacts play in shaping perceptions/representations (and vice versa).

One major issue that needs to be addressed is for researchers to be far more cautious about drawing causal conclusions from regression data. Like Schafft and colleagues (2013), researchers could simply state that an "association" exists, but this appropriate statistical humility is not very helpful if the causal direction of the relationship actually needs to be understood for policy and communication recommendations. Many of the authors cited above have used factor analyses in their data analysis. I recommend taking a detailed look at factor analyses to determine whether the factors are really "environmental", "economic", and "social"

impacts, as some authors have contended, or whether "positive" and "negative" factors might better explain the data structure. If the factors do represent good/bad dimensions, then I urge the researchers to consider why beliefs about the likelihood of impacts and beliefs about the effect of impacts on quality of life should be the same for the set of good impacts and the same for the set of bad impacts (that is, unless assessment of good/bad precedes beliefs about impacts).

I also recommend that social-psychological researchers in this area consider structural equation modeling as a method. Goldberger (1973, 2) reminds us, "In a structural equation model each equation represents a causal link rather than a mere empirical association. In a regression model, on the other hand, each equation represents the conditional mean of a dependent variable as a function of explanatory variables." While the causal direction in structural equation modeling must be established theoretically *a priori*, and cannot be gleaned from the data alone, the structural equation model does allow for model comparisons by positing your hypothesized model against models representing alternative hypotheses. The strong causal assumptions that come with structural equation models, assigning values of zero to all non-specified pathways, further distinguishes regression analysis from structural equation modeling.

IX. Moving Forward

In this chapter, I have made clear the implications of these findings for policy on and communication about shale gas development. Before I conclude this dissertation, however, another set of implications need discussion – the implications of my work for theory and methodology. I contemplate these questions in Chapter Eight.

Chapter Eight: Implications for Theory, Methodology, and Methods

"The word "social" was meant to indicate that representations are the outcome of an unceasing babble and a permanent dialogue between individuals, a dialogue that is both internal and external, during which individual representations are echoed or complemented."
-- Serge Moscovici[28]

"…the babble would not be a babble if dialogue were based purely on repetition and agreement. Just as unceasingly are the sounds of argumentation and negation to be heard."
-- Michael Billig[29]

I. Social Representations Research Today

Assumptions that some SR researchers make are inappropriate based on SR theory. For example, SR need not be hegemonic (see Billig's quote above), but little empirical SR research examines the distribution of positions on key representations. Too much is often assumed about where the discourse is occurring and how it is reaching people; the same sources and channels are not always relevant. Research does not frequently account for the ways in which discourse varies across contexts, and if it does, even fewer studies seek to identify the factors that instigate the variation in discourse. Finally, in studying "a dialogue that is both internal and external", the degree to which individuals or societal-level entities are primarily contributing to thoughts on and conversation about representations is rarely investigated.

My review of recent empirical research on SR in Chapter Three exhibits that, although strongly recommended and perhaps even demanded by SR theory, relatively few SR researchers triangulate across methods within a study. Some researchers who do employ multiple methods still only collect data at a single level (the individual *or* societal). Small, non-random samples in many SR studies that use interviews and/or surveys are also a concern due to questions of transferability/generalizability that arise from such research.

[28] p. 950, 1984. The myth of the lonely paradigm: A rejoinder. *Social Research, 51*, 939-67.
[29] p. 74, Billig, M. 1991. *Ideology and Opinions: Studies in Rhetorical Psychology*. London: Sage Publications.

Much SR research seems to focus almost exclusively on characterizing SR and does not take the next step toward answering additional questions such as the extent to which the representation (1) is shared, (2) is easily molded, (3) defines a group in relation to or in opposition to other groups, and (4) functions to explain the world or to shape behavior. Yet, these further questions are essential for generating findings that are useful for policy and communication about the object, process, or idea being represented. When targeting messages to various audiences, one needs to know the degree to which a representation is shared and easily molded. Policy makers who are trying to address concerns of different constituencies would benefit from understanding the degree to which a representation defines a group in relation or opposition to other groups. When considering possible reactions to policy and communication, knowing the degree to which and ways in which a representation functions to shape behavior could be helpful.

While SR theory is well established after more than half a century of theorizing and empirical data collection, SR research that goes beyond simply characterizing representations to ask more nuanced questions about how those representations operate could support the theory further and advance knowledge of SR in subtle ways. As I mention in Chapter Two, SR theory mostly informs research carried out by European scholars. Research that establishes, rather than assumes, that SR are socially-derived and demonstrates how SR can take various forms (e.g., hegemonic, emancipated, and polemical) could further validate the usefulness of this versatile theory. Such research may help SR gain a greater foothold in American social psychology.

In the remainder of this chapter, I discuss the two major ways in which my research has the potential to forward the study of SR and to advance social psychological research on energy development. First, I review my methodological approach and the methods I used, illustrating how I followed best practices as established in SR theory and how I introduced new methods that could further strengthen SR research. Second, I describe the contribution my research could

make to advancing use of SR theory, specifically in relation to studying representations / perceptions of energy development.

II. Social Representations Research Tomorrow

One of my goals in this dissertation research has been to evince SR theory's usefulness for investigating social psychological questions in my home nation and continent. To affirm the theory's suitability, I first sought to expand the methods used to investigate social representations.

A. Advances in methodology for SR research

SR research proceeding from an assumption that representations are shared and relatively consistent across a population is congruent with the conception of hegemonic representations, but seems to ignore the potential for other (e.g., emancipated or polemical) social representations. I consistently sought, in this research, to identify the *degree to which* representations were social. I followed my newspaper content analysis with interviews of journalists to learn more the primary influences on their reporting. I also stratified the content analysis sample across four newspapers in two states over five years to examine differences across contexts.

I collected data from my key informant interviewees not only on their representations of shale gas development via hydraulic fracturing, but I also investigated how they came by these representations. From whom or what entity did they gain their information? In what settings had they heard, read, and shared representations? Additionally, I conducted my interviews in nine communities spread across three states/provinces in two nations to capture a range of contexts. I explored contextual factors that may have led the interviewees to represent the issue as they did.

In the survey, I asked respondents to describe how often they used each of fifteen information sources to learn about shale gas development and how useful each source was for them. The sources listed in the survey were based on data from my interviews. Many of the questions I asked in the interviews were informed by my content analysis. In the two-level structural equation model, I included societal-level data as a group-level predictor of support for / opposition to shale gas development in municipalities. No single one of my research projects, in itself, revealed the *social* character of the representations I studied. Taken together, however, they begin to paint an image of community / societal-level factors meaningfully influencing representations.

Comprehensive SR research should evaluate the extent to which representations derive from *social* factors (e.g., communication on the local level). SR research should not assume that communication about a particular issue flows via the same information channels as have been used in communication about other issues. ***Recommendation #1:*** The means for representation sharing should be investigated empirically and then evaluated for the extent to which they reveal social- and/or individual-level factors as important influences on social representations. Multiple methods at different levels of analysis are likely required to conduct this type of research.

Beyond establishing the extent to which representations are social, SR researchers could improve the rigor of their data collection and analysis by: (1) increasing their sample sizes, (2) making greater use of random samples, and (3) appropriately stratifying their samples to include a range of social, cultural, and/or geographic contexts. While a number of quantitative approaches to social representations research have been advanced, the amount of data analysis using large, random samples that allow key relationships/hypotheses to be supported (or refuted) with statistical significance remains limited. A tendency toward small sample sizes may owe to the inclination of researchers to want to conduct in-depth analysis of *what* social representations exist before they seek to understand *how* those representations vary across contexts.

The necessity of studying one or the other of these research questions (what vs. how) is a false dichotomy. Nevertheless, studying both does likely necessitate multi-stage research that uses multiple methods. For example, in-depth interviews might need to precede large-scale quantitative data collection. I first conducted about fifty in-depth interviews that then informed creation of questions for my survey. ***Recommendation #2:*** Increase sample sizes without decreasing the extent or quality of in-depth analysis. Include random samples to help with transferability. Compare results across contexts.

Even sparser than SR studies that include large, randomly-selected, stratified samples are studies that make substantial use of close-ended questions. As with avoidance of large sample sizes, the inclination to shun close-ended questions in SR research may stem from a desire to allow research participants to state for themselves how they represent an issue, rather than to ask them to comment on pre-selected representations. Again, however, this is a false dichotomy if we recognize that a researcher can conduct multi-stage, multi-method data collection and analysis. Close-ended questions capture greater variation/distribution in representations than manifest in categorical, open-ended data; they also permit use of additional data analysis techniques which can provide additional insight into relationships between variables (e.g., multiple linear regression, factor analysis, structural equation modeling with latent variables).

I included a number of close-ended questions in my survey. I incorporated many of these questions with the goal of identifying influences on representations of shale gas development. While open-ended data could certainly be used to discern factors that associate closely with representations (e.g., through correspondence analysis, logistic regression, or generalized linear models with binominal distributions), and these data are sometimes analyzed in this way, close-ended questions also allow for identifying such associations and additionally permit the researcher to evaluate variation of opinion across a representation. For example, in open-ended data, respondents could mention a range of valenced statements that reveal support for or opposition to shale gas development. The researcher could qualitatively code the responses as

"support" and "opposition". A close-ended question about support/opposition, however, allows for a variety of response categories (e.g., the six-point scale I used) that speak to the *distribution* and *strength* of support/opposition. The close-ended data, therefore, provide for a more nuanced understanding of the extent to which people hold representations.

Because understanding distribution of responses could be essential for SR research that seeks to characterize how strongly representations are held, researchers should consider six-point scales (see Chapter Three). Five-point scales, due to including mid-points, may artificially alter the distribution of responses if respondents select the mid-point for reasons other than truly being at the center on the scale (e.g., they might select the mid-point due to being unsure or apathetic). ***Recommendation #3:*** Acknowledge the value of open-ended *and* close-ended data collection for understanding SR, and consider both as important information sources with different purposes.

All of the methodological considerations and methods I have mentioned above represent valuable approaches to SR research that few researchers adopt, but that I included in my research to demonstrate further their usefulness. Nevertheless, all of these methods have been used before to some extent and have been advocated for by leading SR theorists. One method I used that has not, to my knowledge, been previously applied to SR research, and that has not been highlighted as potentially useful in any text on SR theory, is structural equation modeling (SEM).

SEM, unlike regression analysis, can be used for hypothesis testing about causal relationships. Such testing can be useful for identifying factors that influence representations. Because an "influence" on a representation is necessarily causally prior to the representation, this type of modeling produces findings that could be more useful than the simple correlations revealed through correspondence analysis or regression analysis.

A second virtue of SEM is that it enables statistically-appropriate analysis of complex survey data. Researchers who include variables in their data sets that are measured on individual *and* societal levels, but who do not account for the hierarchical structure of the data in their modeling, expose themselves to considerable sources of error (see Chapter Three). In my two-

level structural equation model, I showed that several variables measured at the individual level (some of which were indicative of social structure and socially-influenced values) and one variable at the community level were important influences on support for / opposition to shale gas development.

A second method I used that I do not think has been applied previously for examining SR was the generalized linear models I employed to examine variation in representations over time in the newspaper coverage. While this method is not nearly as complex as SEM, I think it may not have been used previously due to the large sample size required to obtain statistically significant results, especially when administering Bonferroni corrections for multiple comparisons.

Recommendation #4: Consider additional quantitative data analysis methods for studying SR. When interested in causal assumptions, when using complex survey data that draw responses from multiple populations, or when seeking to model data measured at multiple levels of analysis, SEM could be helpful, even necessary. Be cautious of common statistical mistakes such as modeling community-level variables at the individual level and modeling all responses to a broad survey together without accounting for stratification (both mistakes ignore non-independence of variance assumptions). Particularly in research on SR, which includes the theory-justified assumption that communication on the local level is important for shaping representations, data analysis must account for the multi-level structure of complex survey data.

To summarize my recommendations for future methodological approaches to SR research, I encourage researchers to:

1. Give more attention to the *degree to which* representations are *social*,
2. Increase use of large, random, stratified samples,
3. Include close-ended questions alongside open-ended questions on research instruments and use data analysis techniques appropriate to each form of data, and

4. Use, where appropriate, data analysis techniques novel to SR research, such as structural equation modeling.

I further recommend that researchers be cautious to employ a sufficient number and diversity of methods that does not cause any of the foregoing recommendations to limit other valuable forms of data collection that are more commonly used in SR research.

B. Extension of SR theory and research into new contexts

The virtues and strength of SR theory for studying the sociology and social psychology of knowledge speak for themselves (see Chapter Two). I do hope, nonetheless, that my few methodological advancements and use of social representations as the organizing theoretical framework for a study of the social psychology of shale gas development in the USA and Canada can help expand the reach of this theory and this research approach. I believe research on social psychology of energy development and American social psychology generally can benefit from greater attention to social representations.

In Chapter Three, I explain that SR theory has only begun to be used in research on public understandings and conceptions of energy development – to examine representations of wind energy development in the UK. Energy development presents an extremely complex range of environmental, economic, and social issues, particularly in relation to unconventional fossil fuel development (i.e., development via hydraulic fracturing for shale gas or oil). Development is almost always highly contentious across local, state/provincial, national, and international levels. These sorts of complex, contentious, and novel/unfamiliar issues are the objects and processes on which social representations are most likely to develop.

Social representations theory, as an organizing framework for my research, allowed me to generate findings about perceptions/representations of shale gas development not yet highlighted in academic literature. For example, by not using "impacts" (or "risks" and "benefits") as a point

of departure (as does much research on shale gas development that comes from an impact assessment, risk assessment, or boomtown literature perspective), I arrived at the conclusion that impacts may be far less important for *shaping* representations than previous believed. By studying social representations of shale gas development broadly, and not assuming what those representations are, I was also able to reveal the substantial import of ethical representations of development, which have yet to be acknowledged in academic literature on this topic. By using a sociological social psychological theory, I was able to illustrate the import to representations of shale gas development of a range of factors from aspects of social structure, to history in a community, to governmental policies and practices, to individuals' values.

Beyond its potential use for studying unconventional energy development, increased attention to SR theory could improve the state of social psychological research in North America. While few American social psychologists use the language of "representations", their approach to studying these phenomena (often termed "public perceptions") is almost a return to Immanuel Kant. In Chapter Two, I quote Stedman-Jones (2000, 49), who writes, "for Kant representations are what the mind, as a set of faculties, produces. For Durkheim, the mind itself is a set of representations". Following WWII, American social psychologists seem to have forgotten much of what their predecessors learned from Durkheim. This is why Farr (1996, 129) claims, "In many ways, it [social representations theory] comprises the antidote to the process of the individualization of social psychology in America."

In Chapter Two, I reviewed much research that strongly cautions against the assumption that individual factors condition the social or that social factors condition the individual. For this reason, I collected empirical data to examine the influence of both social- and individual-level influences. American "social psychology" often simply ignores the social. Even theories such as cultural cognition, which I discussed in Chapter Seven as offering an explanation for some of my findings, seem to take this same approach. My research intimates such an approach is short-sighted. If social psychological research is to accomplish the goal of offering a cogent and

convincing description of how individuals and society interact in ways that affect our everyday existence, it will need theories that do not myopically limit the research focus.

While some people might critique SR theory as going too far in the other, sociological, direction, they would not understand SR theory well if they did so. The quotes that begin this chapter reveal the role of both sociological and psychological influences on representations. SR research that investigates the degree to which representations are social, as I recommend above, also explicitly takes to task any assumption about representations being socially-derived or individually-influenced.

My research has highlighted the value of SR theory for studying representations of shale gas development; yet, one study is not likely enough to make much of a dent in fifty years of entrenched psychological social psychology thinking in North America. One additional means by which SR theory and research might gain greater visibility and use in the USA and North America is if SR were combined with other theories to explain evolution/development of representations. For example, in future research, SR theory could be combined with motivated reasoning and/or the cultural cognition thesis to examine how public discourse and the real life babble of communication produce changes in individual cognitions that then prompt certain modes of processing that lead to acceptance or rejection of social representations. These theoretical approaches could be used in tandem to explain why some issues, for example, elicit hegemonic representations, while others foster emancipated or polemical representations.

Chapter Nine: Conclusion

"We must cling to the belief that the incomprehensible is comprehensible; otherwise we would not continue to search."
-- Johann Wolfgang von Goethe

"Through the mist, through the woods, through the darkness and the shadows, it's a nightmare, but it's one exciting ride."
-- Gaston, *Beauty and the Beast*

I. Dénouement

In this final chapter I offer a brief summary of three key findings from my dissertation research, discuss future directions for my research post-PhD, and finally, I introspectively reflect on the lessons I learned from this dissertation research that I will likely find useful in my future endeavors.

II. Key Findings

Here, I distill from a large conglomeration of results those three findings that I consider to be the most novel, substantial, and intriguing.

A. Direction of causality – support/opposition and beliefs about impacts

My most exciting and valuable finding was the realization that support for / opposition to shale gas development likely *predicts* beliefs about impacts, rather than vice versa. I did not set out to ask questions about causality in this dissertation research; in fact, I fully expected to design conceptual and statistical models in which I would treat support / opposition as my final dependent variable. Even after my extensive interviews in which people's primary representations of this issue were positive/negative, good/bad, I still maintained the view that impacts were influencing, causing, shaping support for / opposition to development.

Only after viewing the results of my factor analysis of beliefs about impacts of shale gas development (from the survey) did I begin to understand that the direction of causality might be

different from previous assertions. The factor analysis clearly showed that the positive effects (economic and social) pooled together on one dimension and the negative effects (environmental, economic, and social) pooled together on a second dimension. The few impacts that did not fit into the two dimensions well were not clearly positive or negative (e.g., increased industrialization, preservation of agricultural land, increased rental housing prices).

Why would the *likelihood* of effects occurring be categorized by whether they were positive or negative? Why would this relationship hold across all 34 municipalities in the survey? The only answer I could muster was that the positive or negative label precedes the determination of each impact's likelihood. Why would effect of impact on quality of life depend on whether the impacts were positive or negative? My research clearly shows that some people value the environment highly, while others primarily value the economy. Yet, the negative factor included environmental, economic, *and* social impacts; different values cannot explain differential consequences of the impacts' effects on quality of life.

Beyond the factor analyses, I reflected on my open-ended survey data in which the most common representations were representations of valence – 81% of respondents mentioned valenced statements while only 64% mentioned *any* impact. Valenced language often existed on its own in the open-ended survey question; it did not modify an impact, but rather was the entire representation. I also recalled my interviews and casual conversations in my study sites in which the guiding framework for every discussion was whether my conversation partners supported or opposed development. Many people mentioned impacts, but they were never the key representation in an interview.

Some interviewees explicitly denied that impacts informed their support/opposition. For example, Sussex and Richibucto interviewees stated they would oppose development even if no negative impacts occurred, due to their mistrust of government and industry and procedural justice concerns. Yet, they still represented development as a series of impacts. Impacts were relevant, but came after a decision "pro-" or "anti-" had been reached. Pro-development

advocates in Dryden and Damascus opposed *regulation* of shale gas development (and supported allowing development), even if no benefits would accrue from development, due to the restrictions that regulation places on private property "rights".

After conducting the factor analyses and considering the other supporting evidence for the directionality of the causal relationship, I ran several structural equation models and found that the ones postulating my hypothesized directionality had consistently better model fit. In fact, while conducting the data analysis on my survey for this dissertation, I had access to two additional data sets in which I could examine the relationship between support for / opposition to shale gas development and beliefs about impacts. (The data came from a survey of randomly-sampled NY residents and a survey of a random national [USA] sample.) For both data sets, the fit of the structural equation models I designed revealed the same relationship as the models for the survey I report on in Chapter Six.

The importance of this shift in directionality from what has been commonly assumed to the opposite has large implications for communication, policy, and research on representations of shale gas development (and potentially energy issues more broadly). I discuss those implications in Chapter Seven.

B. The relevance of ethics

My interviews and survey revealed the considerable significance of ethical considerations for thought about shale gas development and particularly for regulation of development. Nevertheless, the newspaper content analysis and my direct observation of other forms of public discourse (e.g., public meetings, protests, signs, and posters) revealed little attention to such normative issues. Additionally, the way in which my interviewees discussed ethical issues on this topic revealed numerous ethical *claims*, but very little meaningful ethical thought.

The dearth of arguments from my interviewees *against* ethical claims at first surprised me, because the interviewees were constantly trying to refute "facts" about impacts being shared

by the other side of the debate (often which the other side actually did not believe and did not share; see the "misinformation" representation in Chapter Five). As I thought more, the lack of attention to ethical claims made sense; perhaps people saw ethical claims as related to values and realized that values are harder to challenge than incorrect facts. The data from my interviews, however, suggest that values form the basis for almost all representations of development. Only challenging the other side's "facts", especially when one's beliefs about the opponents' "facts" are based on misinformation, will do little to forward the conversation on shale gas development. An in-depth and honest conversation about values and ethics is likely needed.

Perhaps one reason that no interviewees argued against ethical claims is that very few interviewees argued *for* ethical claims. Most claims were just that: claims (opinions) – statements without justification. While the rationale for some claims (e.g., those related to procedural or distributive justice) might be more self-evident than other claims (e.g., those based on property "rights"), it was extremely rare for an interviewee to offer any rationale for his/her assertions. These findings intimate a role for ethical thought in public discourse on shale gas development.

C. "Soft" representations

In much the same way that ethical representations emerged as imperative for representations of this issue in the interviews and the survey, but not in public discourse, "soft" (complex and difficult to quantify) representations of shale gas development were also crucial in the interviews and survey, but far from it in the content analysis. In Chapter Seven, I distinguished the "soft" representations – which refer to less tangible social effects of development – from the "easy" representations of impacts. I contend that representations of development as impacts are mainly heuristics that stand in for, but do not capture the essence of, the main reasons people care about shale gas development. Using, for example, water quality or job creation to represent shale gas development is like the anecdote of the man who was

searching for his keys at night on the sidewalk under the street light. When a friend asked him if that is where he thought he lost his keys, he answered, "No, I lost them two blocks down, but the light is much better here." The "easy" representations do not encapsulate the community character transformations that fundamentally matter for perspectives on shale gas development.

The relevance to views on development of preserving or fostering a specific type of community points to a need to shift discussion of shale gas development away from "the facts". The evidence from this dissertation research, and at least two decades of academic critiques of the information deficit model, suggest that helping people learn the "truth" about development will do little to shape their summary views on this issue. First, beliefs about impacts seem not to shape support/opposition (rather, vice versa); second, people care much more about impacts on which the "facts" are potentially somewhat subjective (e.g., beauty, peace, quiet, visions of the "good life", keeping a community "as is", or revitalizing a community). Values are more relevant to summary judgments on shale gas development than the types of "facts" that ardent supporters and opponents commonly promote.

III. Future Research Directions

A. Research based on key findings

My three key findings highlight ways in which I can build upon my dissertation work going forward. First, causality is messy and difficult to establish. I have offered numerous forms of evidence for my hypothesized causal directionality of support/opposition *to* beliefs about impacts, but additional interviews and factor analyses of survey responses could further substantiate my assertions. I would like to conduct additional interviews, perhaps in new geographical, social, and cultural contexts, and to replicate my survey question about beliefs about impacts in additional surveys. As of this writing, I am designing a survey for dissemination in September 2014 that will hopefully include this question.

Second, the lack of attention to ethics and "soft" social effects in public discourse, and particularly in the policy process, is disturbing. I see my work to address this problem taking two divergent paths. To establish the pertinence of "soft" social effects to the general public, I would want more evidence that this is the case. I could rely on the findings from the aforementioned follow-up interviews and survey work. If the resulting data support my previous findings, I would write policy briefs and share my research with mass media outlets to try to convince decision makers to address to these effects more attentively in the policy process.

I see the problem with the lack of attention to ethical considerations differently. The only way to increase understanding of why more (and better) ethical thought is needed is to first demonstrate how that ethical thought can be useful. This is a difficult project, but one which I will endeavor to tackle. I would like to create the ethical argument for why shale gas development should be regulated in a certain way. Unlike nearly all ethical claims I have heard on this issue, I will seek to create a philosophically-justified position. For example, "rights" cannot simply be asserted; they need to be based in something. I would seek to identify all possible derivations of property "rights" and "rights" to clean air and water. Likewise, broad claims against preventing "harm" are not defensible. To even begin to forward arguments about regulating development based on "harm", one would need to articulate a principled and non-arbitrary threshold for the level of harm that could and could not occur. I would like to undertake this task as part of my ethical evaluation of shale gas development.

Another finding from this dissertation that warrants further investigation is the differential effects of support for development and opposition to development on beliefs about importance of sustainability and resilience for one's community's future. In future interviews, I would like to explore more in-depth the representations of the word "sustainability" and "resilience" themselves, as well as communities' and residents' thoughts about the specific items I used to operationalize these constructs in my survey. In future surveys, I seek to include these same items, but also to expand the question about sustainability and resilience by adding

additional measures that are associated with the academic constructs of "sustainability" and "resilience", to increase the validity of the factor analyses measuring these two concepts.

B. Additional research opportunities

Beyond the ways in which specific major findings from my dissertation will influence my future work, the state of research on social psychology of energy development more broadly will shape my evolving research program. I see a need and opportunity for international comparisons on representations of shale gas development. I am not aware of any research that has been published in the area of comparative sociology / social psychology of this form of energy development.

Shale gas development is increasingly emerging as a major topic of political debate in not only the USA and Canada (discussed in this dissertation), but also in the United Kingdom, several nations in continental Europe, and Australia. Additionally, social representations likely operate in novel and interesting ways at the international (between-nation) level. International comparisons would introduce further interesting variables for analysis, particularly differences in regulatory regimes. International regulation of shale gas development, for example at the European Union level, could also present an exciting series of variables germane to social representations of this phenomenon.

I have begun collaborating with UK researchers and am on track to conduct the aforementioned survey in September 2014, which will include a USA sample and a UK sample. I also intend to strengthen my relationships, over the next couple years, with the Canadian collaborators with whom I have worked on energy issues. I will constantly look for opportunities to build off these initial collaborations to expand further my network and geographic focus.

Particularly if my research does acquire an increasingly international focus, the sub-topic of "energy independence" as it relates to shale gas development will become progressively more

relevant to my work. I afforded little attention to energy independence in this dissertation because it was such a minor representation in my newspaper content analysis, interviews, and survey. My content analysis captured coverage from 2007-2012; my interviews and survey took place in 2013.

It was not until early 2014 that Russia annexed Crimea, which led to political destabilization in Ukraine and Eastern Europe. This action also led to European Union concerns over natural gas, which flows in large quantities from Russia to Europe through Ukraine. The morning on which I typed this chapter (16 June 2014), a front page article on nytimes.com appeared, titled "Gazprom stops supplying natural gas to Ukraine". The first sentence read, "The Russian energy giant Gazprom stopped supplying natural gas to Ukraine on Monday, warning that the reduction could diminish the amount of gas flowing to the rest of Europe…". President Obama has been lobbied by European heads of state to facilitate greater exports of natural gas from the US to Europe to reduce European dependence on Russian supplies. The future of this issue will undoubtedly shape my research into social representations of shale gas development. I would like to be on the forefront of understanding social representations of so-called "energy independence" and how these representations affect (and are affected by) other representations on this issue.

Representations of energy independence in relation to shale gas development have the potential to instigate evolution in representations of shale gas development in the USA, especially if more development occurs in the States due to increased demand and capacity for international exports. Representations of this issue are not static; they have potential to change for many reasons over the next few years. Therefore, I have interest in conducting a follow-up survey with the 1202 respondents to my survey of Marcellus Shale residents. One aspect of social representations that I was unable to investigate in detail in my dissertation was longitudinal change in representations. I did examine this in the newspaper content analysis, but I see value in following up with the same group of NY/PA residents at a later date, perhaps after

some important developments in the discourse on and/or regulation of this issue. I would gauge the extent to which and ways in which representations evolve.

From my ideas for future research thus far, it is evident that I plan to continue using social representations theory as the guiding approach for designing, executing, and analyzing my research. With the modifications I have made to the manner in which social representations research is typically conducted (see Chapters Three and Eight), I find this research approach both theoretically nuanced and useful for asking the questions in which I am interested. I also view my continued use of social representations theory as a way to repeatedly expose North American social psychologists to this approach – through my publications, teaching, and presentations. A long-term goal for my research is to chip away at the wall that divides psychological and sociological approaches to social psychology.

For the next two to three years, I do not see my research expanding far beyond social representations of shale gas development in terms of content focus. Three to five years from now, I plan to expand my research into social representations of other forms of energy development. I believe this will be a logical progression from my current work and my research in the near future.

IV. Lessons Learned

Academic inquiry presents a shifting baseline. As the researcher learns more about a topic, he/she learns how much more there is to discover; part of the mystery always remains unsolved. Goethe reminds us to "cling to the belief that the incomprehensible is comprehensible". Each research project, each study helps us identify additional interesting (temporarily) incomprehensible questions and gives us additional tools to make those questions comprehensible.

A. Designing research

I learned how valuable a solid theoretical framework can be for facilitating meaningful research. Using social representations theory to guide my inquiry made this dissertation more exciting and revealing than it would have been, had I used a theory that limited the scope of study in the fashion of traditional psychological social psychology. Social representations theory proved flexible, intuitive, and easy to implement. I am particularly satisfied with my approach to studying social representations as *potentially* manifest phenomena in my communities (and not simply *assuming* their existence). The extent of my triangulation, between methods of data collection and methods of data analysis, also increased my confidence in my findings.

This dissertation research, and my buttressed appreciation for social representations theory, has negated my ability to feel comfortable doing a quick, single-method study. In the future, I may undertake such research out of time and resource constraints, but the dissertation has helped me view each individual study as part of a larger research project and has given me greater vision for how I can use each individual study to continually build on previous work, in terms of content, theory, and/or methodology.

I learned that I cherish qualitative and quantitative research. Social representations theory requires a range of methods; furthermore, a nuanced understanding of any issue requires balance between breadth and depth. Qualitative research helped me discover and refine my perceptions of the most interesting questions worth asking; quantitative research helped me convincingly answer those questions. Beyond these academic, methodological arguments, however, both forms of research are simply fun. I would not feel complete without experiencing both within a given project. Being in communities with real people, listening to their stories, and piecing together an overarching narrative that describes what I heard and experienced in these unique communities is priceless. Amazingly, I find an equal but different type of joy in mining an SPSS data set or writing and executing M*plus* code for ten hours straight. In both qualitative and quantitative research, one can be a true detective.

I learned the value of picking a research topic that is relevant to the general public in the geographic area where I am conducting my investigation. While previous issues I have studied have been valuable research topics, have presented compelling research questions, and have generated interesting findings, I have never before studied an issue that foments such public discourse as shale gas development. By selecting a topic with intense relevance to even the casual citizen on the street, I was able to understand representations of this issue through a host of media that would not be available for other issues (e.g., informal conversations, constant newspaper coverage, lawn signs, posters, protests, countless public meetings). This variety is important for studying social representations well and it makes the research process more exciting. Topics relevant to the general public also increase the potential usefulness of one's research for communication and policy.

B. Carrying out research

I learned that no matter how important you think a question is in your survey, you always need to be conscious of potential survey fatigue. While I am not disappointed with my 28% response rate, I would have liked for it to be higher. I could have included fewer questions on the survey and likely increased my response rate; I would have also likely eliminated questions that were essential to the findings reported herein. In future surveys, I will establish a lower maximum number of questions. The questions on which I was able to conduct factor analyses were particularly useful for generating meaningful findings. I will be sure to value such questions in future surveys.

I learned why some people do not respond. When conducting my drop-off and pick-up follow up, I walked to houses and apartments in extremely depressed areas. The harsh reality I experienced while roaming the dilapidated halls of tenement-style residences was that these people have far more important and pressing uses for their time than filling out my survey. I learned to be content with low response in some areas. Nevertheless, I learned that the drop-off,

pick-up method can substantially increase response rates. I will consider employing this approach from the start with future surveys in urban areas and other areas where I would expect low response rates and where this method would be feasible.

I learned the value of an iterative research process. Starting with the content analysis, moving to the interviews, and ending with the survey helped me gain a broad understanding of the social representations at play on this issue. Having time to digest the findings of each study before moving onto the next project was essential. While time and financial resource constraints apply to all research, I see additional value in conducting follow up interviews in which I could share my findings and interpretations from the survey with community residents, and then listen to their feedback. Perhaps focus group discussions could be particularly useful in this respect, as they would allow for discussion of social representations in the natural environment in which social representations emerge. Some representations might even evolve during the conversation. Focus group discussions as follow-up interviews would also allow me to speak with a greater number of people in a limited period of time.

I learned that study site selection for research such as mine is intense, but it pays off to do it well. I spent close to four months just researching potential study sites – I conducted reconnaissance visits, I spoke with people who knew these places, I read newspaper articles, I scoured Census data, I did Google searches, I learned about groups active on this issue, I poured over lease maps, I read through meeting minutes, I spent hours in local diners and bars. Of course, I still had surprises when I began my official site visits and interviews in each community, but I had a good idea of what I could expect. I understood the ethos of the place well enough to produce some good follow-up questions I would not have conceived of otherwise. I also learned that no matter how well you think you know an area or how close you live to it, you should spend a few days *residing* in each study site. I am pleased with my research on all fronts, but I certainly *know* my New Brunswick study sites better than my New York or Pennsylvania sites. I attribute this to my day trips to the NY and PA municipalities compared

with my four straight days of engraining myself in the local mindset of each of my NB communities.

C. Reporting research

I learned that different audiences will find different kinds of information convincing. My interviewees (including the journalists) shared the numerous channels by which they learned of shale gas development. For almost everyone I spoke with on this topic, their impressions, views, and knowledge were shaped by a mix of anecdotes and assorted data. Stories can be intuitive, exciting, humorous, suspenseful, frightening, and heart-wrenching. Numbers and statistical analysis can be weighty but also powerful when used to justify an argument. I learned that I want to make my research known in the form of data to academic communities, but also that I want to make my findings available to the general public through narrative, whether that comes from a book or a collection of shorter journalistic pieces.

I learned to develop thick skin and to not take rudeness, belligerence, and willful ignorance personally. I conducted research on a contentious topic. I think many of my interviewees expected that I, who had nuanced views on this topic, would naturally see the virtue in their position, join their "side" in the debate, and help them fight for their cause. I never joined any "side". This opened me to attack. On an issue such as the one I studied, if you are not "with" someone, you are often perceived as against him/her. Within a two week period, my research was attacked on a pro-development blog and an anti-development e-mail list-serve. Nasty, uninformed comments were slung my way from people who clearly opted out of taking an introductory methods course. The good thing about such comments is that they are quite easy to dismiss due to how ignorant they are, as long as your pride does not make you too emotional. I learned to stand tall and walk away from pointless diatribes.

D. Final lesson

I learned how joyful, lively, and entertaining research can be. I have enjoyed research projects prior to my dissertation work; I would not likely have undertaken a PhD otherwise. I have never before, however, loved my investigation, analysis, and writing to such an extent. I am not even talking about that time at Morgan's Pub in Richibucto when I bought a round for the whole bar (to gain trust and rapport with the locals, of course) and then chatted openly about local views on "fracking" well into the morning. I am not even referring to those two days straight of one pound lobster dinners for lunch on the Bay of Fundy while doing my research in Sussex. I *am* talking about the utter bliss that comes from starring into a set of complex questions for days, weeks, months, and years on end and gradually developing some new insight into how society and its members operate. Goethe was right, the incomprehensible can be made comprehensible, but perhaps even more valuable than the final knowledge is the journey – the delight of the search.

Appendix A: Institutional Review Board (IRB) approvals for three studies

Approval for interviews with journalists

Cornell University
Office of
Research Integrity and Assurance

East Hill Office Building, Suite 320
395 Pine Tree Road
Ithaca, NY 14850
p. 607-255-5138
f. 607-255-0758
www.irb.cornell.edu

Institutional Review Board for Human Participants

Concurrence of Exemption

To: Richard Stedman
From: Matthew Aldridge, Senior IRB Administrator
Date: October 10, 2012

RE: **Protocol ID#:** 1101001927
Project(s): Social Elements of Natural Resource and Environmental Management

The IRB staff has reviewed the amendment request for the above-referenced protocol and found it to continue to qualify for **Exemption from IRB Review** according to paragraph #1, 2, 3, 4 of the Department of Health and Human Services Code of Federal Regulations 45 CFR 46.101(b).

This proposal has not been evaluated for scientific merit, except to weigh the risk to the human participants in relation to the potential benefits.

Please be aware of the following:

- This exemption notice covers the following amendments to the study: (1) addition of Darrick Evensen (dte6) and Chris Clarke as research personnel, and (2) addition of a procedure to interview journalists to understand mass media coverage on certain effects related to gas development.
- Exemption from IRB review does not absolve the investigator from ensuring that the welfare of the research subjects is protected and that methods used and information provided to gain participant consent are appropriate to the activity. It is your responsibility as a researcher to familiarize yourself with and conduct the research in accordance with the ethical standards of the Belmont Report (http://www.hhs.gov/ohrp/policy/belmont.html).
- You must notify the IRB office of changes or amendments to the above-referenced protocol **BEFORE** their implementation.
- You are not required to submit progress reports or requests for continuing review/approval to the IRB office, unless you modify your study protocol.

Approval for in-depth interviews in the nine study communities in NB, NY, and PA

Cornell University
Office of
Research Integrity and Assurance

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395 Pine Tree Road
Ithaca, NY 14850
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Institutional Review Board for Human Participants

Concurrence of Exemption

To: Richard Stedman

From: Katie Nickless, Compliance Admin., ORIA

Date: April 12, 2013

RE: **Protocol ID#:** 1101001927

Project(s): Social Elements of Natural Resource and Environmental Management

The IRB staff has reviewed the amendment request for the above-referenced protocol and found it to continue to qualify for **Exemption from IRB Review** according to paragraph #2 of the Department of Health and Human Services Code of Federal Regulations 45 CFR 46.101(b).

This proposal has not been evaluated for scientific merit, except to weigh the risk to the human participants in relation to the potential benefits.

Please be aware of the following:

- This exemption notice covers the following amendments to the study: Addition of study population for research on perceptions and discourse on natural gas development, add list of questions, update consent and recruitment accordingly.
- Exemption from IRB review does not absolve the investigator from ensuring that the welfare of the research subjects is protected and that methods used and information provided to gain participant consent are appropriate to the activity. It is your responsibility as a researcher to familiarize yourself with and conduct the research in accordance with the ethical standards of the Belmont Report (http://www.hhs.gov/ohrp/policy/belmont.html).
- You must notify the IRB office of changes or amendments to the above-referenced protocol **BEFORE** their implementation.
- You are not required to submit progress reports or requests for continuing review/approval to the IRB office, unless you modify your study protocol.

Approval for survey

Cornell University
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Institutional Review Board for Human Participants

Concurrence of Exemption

To: Richard Stedman

From: Katie Nickless, Compliance Administrator, ORIA

Date: July 09, 2013

RE: **Protocol ID#:** 1101001927

Project(s): Social Elements of Natural Resource and Environmental Management

The IRB staff has reviewed the amendment request for the above-referenced protocol and found it to continue to qualify for **Exemption from IRB Review** according to paragraph #2 of the Department of Health and Human Services Code of Federal Regulations 45 CFR 46.101(b).

This proposal has not been evaluated for scientific merit, except to weigh the risk to the human participants in relation to the potential benefits.

Please be aware of the following:

- This exemption notice covers the following amendment to the study: Expand the study by randomly mailing 5,220 residents living in Southern NY and Northern PA environmental surveys.
- Exemption from IRB review does not absolve the investigator from ensuring that the welfare of the research subjects is protected and that methods used and information provided to gain participant consent are appropriate to the activity. It is your responsibility as a researcher to familiarize yourself with and conduct the research in accordance with the ethical standards of the Belmont Report (http://www.hhs.gov/ohrp/policy/belmont.html).
- You must notify the IRB office of changes or amendments to the above-referenced protocol **BEFORE** their implementation.
- You are not required to submit progress reports or requests for continuing review/approval to the IRB office, unless you modify your study protocol.

Appendix B: "Marcellus Shale" newspaper content analysis coding scheme

Overview: The coding scheme below will help you analyze newspaper articles about natural gas development in the Marcellus Shale region.

Coding Process for Each Article:

***** Throughout the coding process, please input all data into the Excel sheet provided to you.

Step 1: Article Background Information

Background information on each article, such as: title, author, date, and whether it is a letter to the editor or an editorial is already filled in on the Excel sheet.

Step 2: Framing of Drilling-Related Impacts

Does the article discuss any potential or actual impacts of natural gas drilling?

Yes = Code each impact as outlined below

No = Write "none" under each category (environmental, economic, and social) in which no impacts are discussed and then go to Step 3 (Fairness)

A. Write down the *specific impact* as it appears in the article and place it under the appropriate general category (environmental, economic, or social). The table below includes specific types of impacts you may encounter within each category. These codes were compiled from a review of several articles, but other impacts may exist. Please use these codes if they apply (the code name is the word(s) written in bold lettering in the table below); if the impact you find does not fit a code listed here, create a new code and we will review it together after the coding process is complete. Code each specific impact only once, regardless of how many times it appears in an article.

Note: "Natural gas development" includes not only drilling for gas but also all related industries and processes such as truck transportation, water processing, and waste removal. The effects of the gas development can sometimes be rather removed from the gas drilling itself (e.g., impacts on tourism due to less hotel rooms being available because gas industry workers have rented out all the rooms locally).

General and Specific Impact Category Descriptions

Coding category	Examples
***Environmental* effects of natural gas development**	• Effects on **drinking water** • Effects on **lakes** • Effects on **streams/rivers** • Effects on **water supply** (e.g., due to volume of water used) • Impacts related to **wastewater** • Other references to **water quality** that are too vague to fit the categories above (e.g., "water quality could be affected") • Problems related to **methane migration** (e.g., methane gas getting into basements or water wells) • Concerns about **NORMs** (i.e., naturally occurring radioactive materials) • Effects on **soil quality** • Effects on **wildlife** (this term is generally used for terrestrial non-domesticated animals) • Effects on **fish** and other aquatic animals (references to decreased fishing opportunities can also be placed here) • Effects on **habitat** for wildlife (terrestrial habitats; the animals' homes) • Effects on **forests** • Production of **solid waste** (e.g., rock cuttings, sludge, etc. that needs to be disposed of) • Effects on **air quality** (e.g., air pollution from drilling rigs or truck traffic) • Production of **clean energy** by increasing natural gas available • Effects on **greenhouse gas emissions** (either more or less) • **Broad** environmental effects (i.e., the article mentions that some aspect of natural gas development effects the environment, but it does not further specify the effect)
***Economic* effects of natural gas development**	• Effects of gas development on local, municipal, county, or state **tax revenue** • Effects on **taxes** that residents pay • Effects on **jobs** (including availability of jobs, wages paid, provision of job training opportunities, etc.) • Discussion of financial aspects of **leases** • Discussion of financial aspects of **royalties** • Discussion of financial aspects of **mineral rights** • Effects on **local business** (e.g., industries and shops in the community)

	• Effects on **property values** • Effects on **tourism** • Effects on price of houses or **rental** property • Discussion of costs related to **water treatment** • Discussion of costs necessary for site **remediation** • Production/provision of **cheap energy** • **Broad** economic effects (i.e., the article mentions that some aspect of natural gas development that relates to economic considerations, but it does not further specify the effect; this could also be a code for a general reference to "economic growth")
***Social* effects of natural gas development**	• Effects on **traffic** (amount of traffic, traffic patterns, etc.) • Effects on condition of **roads** and bridges • Effects on driving and pedestrian **safety** • Effects on **crime** rate • Effects on community and/or emergency **services** (e.g., ability of a community to provide for the basic needs of its citizenry) • Effects on community **infrastructure** beyond roads and bridges (this could also be used for a broad reference to "infrastructure" that does not further specify what that word means) • Effects on **parking** (availability, need for, etc.) • Effects on **housing** availability • Effects on amount of **noise** • Effects related to **light pollution** • Issues related to **dust** from trucks and heavy equipment • Effects on local **aesthetics** • Issues related to the **distribution of gains** earned from leasing land for natural gas development • Effects of natural gas development on leading the US toward **oil independence** (could be phrased as 'energy independence', or the reduced need to import foreign fossil fuels) • Effects on **community character** or a rural way of life • **Broad** social effects (i.e., the article mentions that some aspect of natural gas development effects local communities, but it does not further specify the effect)

** For example, if the article contains the following sentence, "Fracking in the town has led to complaints about contamination of drinking water and too much light and noise at night", you would code it as "drinking water" under the "environmental" category and as "noise" and "light pollution" under the "social" category.**

B. Specific impact as minor or major emphasis – At times, it may be clear after reading an article that one specific impact(s) stands out as the primary focus of the article. If so, place the designation "P" next to that impact(s) on the spreadsheet. For example, if the article is

clearly about potential drinking water contamination as a result of drilling, you would write the following under the "environment" general category: "drinking water (P)."

However, at other times, it may appear that no impact(s) stands out as a single primary focus of the article. If that is the case, do NOT writing anything besides the name of the specific impact placed in its appropriate category.

Primary vs. Minor Emphasis Category Descriptions

Coding Category	Examples
Primary emphasis (P)	A specific impact is mentioned multiple times in an article, is a substantial focus of the coverage, is in the title, and/or is prominently featured in the first (lead) paragraph
Moderate/Minor emphasis	A specific impact is *not* mentioned multiple times (or at least in a way as to *not* suggest a primary focus); is *not* in the title and/or featured prominently in the first (lead) paragraph.

NOTE: This designation ONLY applies to *specific* impacts, NOT general categories.

C. **Valence of impact:** Whether each specific impact is presented in a positive, negative, or neutral fashion (or as both positive and negative at different points) in terms of whether its potential or actual effect is *good* or *bad.* There are 3 types of valence.

Valence and Fairness Category Descriptions

Coding category	What to write on coding spreadsheet	Examples
Positive valence	"+" under "Val" to the right of the general category of the impact for which you are coding	A specific impact may have/is having a positive effect. For example: Marcellus Shale development is a *good thing* because it will/may create jobs and help economically depressed areas of New York. Look for keywords such as *positive, beneficial, increased opportunity, etc.*
Negative valence	"-" under "Val" to the right of the general category of the impact for which you are coding	A specific impact may have/is having a negative effect. For example: Marcellus Shale development is a *bad thing* because it will/may contaminate water supplies/wells in some areas. Look for keywords such as *negative,*

	(**note:** you actually need to type a single quotation mark (‘) and then the negative sign for this to not function as an equation symbol in Microsoft Excel)	*bad, risk, pollution, harmful, etc.*
Neutral valence	“0” under “Val” to the right of the general category of the impact for which you are coding	No mention of a good or bad effect associated with a specific impact. In such instances, the potential or actual impact will merely be *mentioned*, such as the fact that wastewater and rock cuttings are created when fracking occurs.

NOTE: In some instances, an article’s focus on valence of a specific impact may center on *multiple* impacts simultaneously. For example, an article might state that drilling is bad because some people may have their water contaminated but also good because some people may benefit by leasing their land. In this instance, code the valence and distributive fairness of both impacts *separately.*

Additionally, if one impact is discussed with both a positive and negative valence at the same point or different points within an article (for example, one politician says the impact is positive, but another says it is negative), code the valence as positive and negative.

D. **Solutions to potential/actual impacts –** Does the article discuss any solutions to potential/actual impacts, such as actions being taken by local/state/federal governments (i.e., zoning to mitigate surface impacts; developing regulations related to water withdrawal, etc.)? Do not count studies being done to quantify the impacts as solutions. They are coded in another category. If a source or a journalist makes the claim that some people say that a certain impact may be a problem, but that it is not really a concern, this often fits under the category of solutions being present. If one or more solutions are present within an article, write “Yes” under the “Solutions” heading. Otherwise, write nothing.

Step 4: Fairness of distribution

- **Fairness:** In discussing the effects of natural gas development, does the article, or sources quoted in the article, suggest that distribution of the effects (who benefits; who bears the risks/costs) is fair or unfair. There are 3 potential codes for this category.

An article could note that distribution of the effects of natural gas development is fair or unfair, or the article may not mention fairness at all, in which case you would note that discussion of fairness is absent.

Fair: The article explicitly mentions that the distribution of the effects of an impact (positive, negative, or neutral) are/will be *fair*; for example: that the economic benefits such as job creation will benefit everyone in a community or many different types of people/groups in a community.

Unfair: The article mentions that the distribution of the effects of an impact (positive, negative, or neutral) will be *unfair;* for example: only some people, such as landowners, will be able to lease their land and obtain financial benefits. A more negative example could be that certain individuals in a community are more vulnerable to having their water contaminated than others (e.g., because they are on well water, versus municipal water).

Step 5: Article Relevance Regarding Marcellus Shale

Please determine the relevance of the article to the issue of natural gas drilling in the Marcellus Shale.

I. *High relevance* – more than 50% of the article is focused on Marcellus Shale gas drilling; AND/OR the first three paragraphs (of at least 3-4 sentences) are clearly about this issue; AND/OR gas drilling/Marcellus Shale is mentioned in the article title.

II. *Moderate relevance* – less than is 50% of the article is focused on Marcellus Shale gas drilling BUT at least one paragraph (of at least 3-4 sentences) is clearly about this issue.

III. *Low relevance* – less than one paragraph (of at least 3-4 sentences) is clearly about natural gas development.

Step 6: Quoted or paraphrased sources that discuss drilling-related impacts

Are any sources directly quoted in the article or paraphrased, in which an article summarizes comments attributed to a source using words like "said", "asserted", "claimed", "expressed", "argued", or "stated?"

We are *only* interested in sources, quoted or paraphrased, that comment specifically on gas-drilled related impacts.

Yes = Write down the affiliation of <u>each</u> source as it appears in the article. For example, if John Smith from the Tompkins County Landowner's Coalition is quoted, you would write "Tompkins County Landowner Coalition" on the spreadsheet verbatim. However, if no organizational or institutional affiliation is provided, such as John Smith, a local landowner, write "unaffiliated" on the spreadsheet. Affiliations could include state agencies (e.g., NY DEC, PA DEP, PA Fish and Boat Commission), state senators, state representatives, town officials, county commissioners, college professors, industry officials, advocacy groups, etc. Write the affiliation, not the name of the individual. For example, all state representatives can simply be coded as "state representative"; anyone in the NY Governor's office can be coded as "NY Governor".

No = Go to Step 7

Step 7: Studies Done on Potential or Actual Impacts of Natural Gas Drilling.

Does the article mention any studies that have been done on potential or actual impacts of unconventional natural gas development in the Marcellus Shale?

Yes = Briefly describe the study under the column "studies." For example, if the article talked about the SGEIS (Supplemental Generic Environmental Impact Statement) being developed by the New York State DEC, write "SGEIS" or "DEC environmental impact study" in this column.

Also, code any criticisms or critiques of the study under the column labeled "Complaints." These include, for example:

- *Need for more research in the future* on potential or actual impacts that were either not addressed at all or addressed in a way that some perceive as insufficient; that the study needs to *do more/has not done enough* in this regard. For example: a study should focus (more) on the human health impacts of natural gas drilling; study is flawed and should not be used, should be withdrawn; was done incorrectly, not thoroughly, etc.

- *Perceived fairness of the study itself OR of the entity/entities who conducted the study*: For example, the study was biased/unbiased toward a drilling viewpoint (pro or con); the entity/entities doing the study is biased/unbiased in this regard. A source may assert that the study was too focused on economics, or not focused enough on social or cumulative impacts. In cases of bias, also note who (what group) lodged the complaint.

** In noting any criticisms or critiques of a study, please provide <u>as much detail verbatim</u> from the article as possible .**

No = Go to Step 8

Step 8: Mobilizing Information

Does the article discuss any mobilizing information in regard to unconventional natural gas development? Mobilizing information enables readers to act on attitudes that they may already have about an issue.

Yes = Code each example of mobilizing information as described below.

- **Meeting –** Does the article discuss public meetings about gas drilling that will occur in the future? Do not code for meetings that have already happened. Examples of public meetings include those sponsored by landowner coalitions, local government officials, state government officials (e.g., public hearings sponsored by the NYS DEC or PA DEP on the

agency's proposed regulations), federal government officials (e.g., public hearings sponsored by the EPA), etc. For this category, simply write "Yes" or "No".

- **Date** – if a future meeting is mentioned, note whether the date it will occur is listed. For this category, simply write "Yes" or "No" (if no meeting was mentioned, leave this category blank).

- **Time -** if a future meeting is mentioned, note whether the time it will occur is listed. For this category, simply write "Yes", or "No" (if no meeting was mentioned, leave this category blank).

- **Location -** if a future meeting is mentioned, note whether its location is listed. For this category, write "specific" (if an address is given or exact location is provided such as "elementary school auditorium in town X"), "general" (if simply a region or area is given, such as "a meeting will take place in Binghamton"), or

- **Contact info. (meetings) –** if a future meeting is mentioned, note whether contact information is provided that would enable someone to learn more about it. Write down the type of contact information provided (e.g., e-mail, website, phone number, etc.); if nothing is provided, write "No".

- **Contact info. (not meetings) –** Does the article include any contact information for advocacy/non-profit organizations such as environmental groups or landowner coalitions (provided such organizations are mentioned)? Write down the type of contact information provided (e.g., e-mail, website, phone number, etc.); if nothing is provided, write "No".

- **Learn more (not meetings) –** Does the article include websites or other information about accessing drilling-related documents such as the SGEIS (provided such documents are mentioned)? Write down the type of information source provided (e.g., website, publically available document, etc.); if nothing is provided, write "No".

Appendix C: Interview guide for conversations with journalists

Introduction: I am interested in your coverage for [name of regional newspaper] from 2007-2012 on issues of natural gas development in the Marcellus Shale.

Background introduction about my research: I am conducting a content analysis of regional newspaper coverage of natural gas development in the Marcellus Shale; I noticed a difference in the focus of reporting across four regional newspapers (e.g., effects of gas development, valence, and sources). I am trying to discover why…

Background

1. Generally, across **the range of issues** covered by the *[name of regional newspaper]*, what role do you think the newspaper plays in the local communities? What is the **function of the newspaper**? To inform? To expose? To clarify? How would you word it?
    a. What about on the issue of Marcellus Shale natural gas development specifically?

Shale Gas Development-Specific

2. **How did you become involved** in reporting on the issue of unconventional natural gas development?

3. On this issue, as a journalist, **who was your audience**? What was your **coverage area**?

4. Who have you identified as the **main affected parties** in your coverage area? Who are the **main sources of information**?

5. As a journalist, what did you see as your **role** in reporting this issue?
    a. Educating?
    b. Providing "balanced" information?
    c. Mobilizing?
    d. Investigative reporting?
    e. Identifying solutions?

6. In covering these issues, what **key messages** have you tried to get across? Have you succeeded?

7. How important do you think this issue is to your **audience**? What do you think your audience most wants to know about this issue? Why? How did these aspects of your audience affect your reporting?

8. Has it been difficult for you to "straddle" **the line between reporting as a journalist and thinking about personal feelings** you may have toward this issue? Is it difficult to remain neutral? Do you think other journalists covering this issue have faced similar challenges?

Appendix D: Interview guide for key informant interviews

Introduction: I am interested in how shale gas development via hydraulic fracturing has been discussed in your community, what knowledge and beliefs community members hold about gas development, and how you see gas development affecting the future of this region (the area you consider your local community).

Social Representations

1. [Hand the interviewee a blank sheet of paper, divided into four equal boxes.] Ask the interviewee to take a few minutes to **use words or drawings to put something in each box that comes to mind when I say "shale gas development (or extraction) via hydraulic fracturing"**. Just write down the first things that come to mind.

2. Ask the interviewee to explain his/her responses:

    a. Why did you use these words/images?
    b. Why were these words/images important or relevant to you?
    c. How did you come to focus on these?
    d. How did you learn about these issues?
    e. When did you first become exposed to issues of shale gas development?
    f. Has your understanding or impression of shale gas development **changed over time** (would the words/images have been different previously)?
    g. To what extent are these topics discussed locally? For example, in meetings, mass media, rallies, posters, signs?
    h. What other topics related to shale gas development are frequently discussed locally?

Understanding the local community context

3. Tell me about your community. **(Keep this question brief; do not dwell here.)**
    a. What **values** are most important here? How do these relate to your own values?
    b. What **shared history** is important?
    c. To what extent are local residents **individually-focused or community-focused**?
        i. For example, do local residents favor a high degree or collective control, or are they more likely to view individual self-sufficiency as preferable?
        ii. Do local residents favor stratification (several levels) of roles and authority, or prefer a more equal community structure?
    d. Tell me about who makes up this community (e.g., length of residency, migration, is it diverse ethnically, linguistically, is it divided by religious affiliation?).

4. **How did you become involved** with issues related to shale gas development in this community? What has your **role** been?

5. How, if at all, has/have **the following affected knowledge and/or beliefs** about "shale gas development" in your community (when I say "shale gas development", I mean all actions and processes related to leasing land, testing for gas, site preparation, drilling, gas extraction, transport, ancillary industries, and related social and economic changes)?

    a. **Local experiences** related to gas development
    b. Cultural values
    c. Extent of **gas development** locally
    d. Local **history** (e.g., of sub-surface extraction and natural resource use in general)
    e. Presence of certain **organisations or institutions**
    f. **Information sharing** about natural gas development (which sources)?
    g. National, state/provincial, versus local conversations/discourse?
    h. **Natural surroundings** (aesthetics, beauty)?
    i. Local **health concerns** and concern for **environmental quality**

Community Sustainability (in light of shale gas development)

6. I would like to conclude our conversation with a few questions about your community moving forward. What does it mean to you to have a "sustainable community"?

7. What do you envision as a desirable **environmental, economic, and social future of this community**?

    a. Is this vision **widely-shared** in the community? Are there **competing visions**?
        i. If so, what are they? Who holds them (i.e., are there certain groups that have particular visions)?
        ii. Are there interests or forces from outside the community that are able to impose their visions on this place?

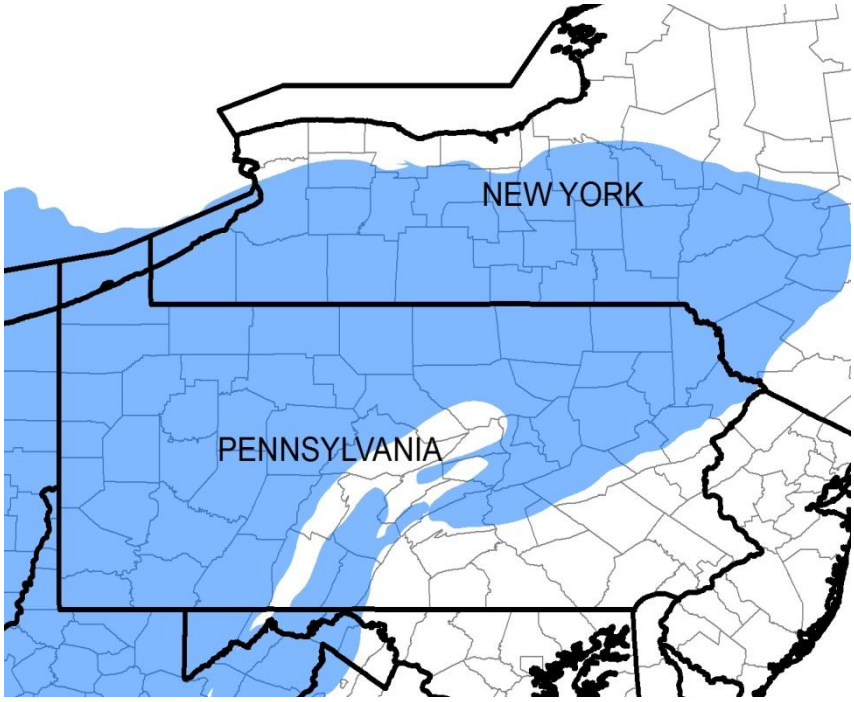
8. What **actions** have individual community members or the community as a whole taken **to work toward these visions**?

9. Does government regulation provide any constraints or opportunities toward achieving these visions?

10. Do you have anything else to add or any additional aspects of these issues that you would like to address?

Appendix E: Survey to NY and PA residents

Community well-being and shale gas development in the Twin Tiers



The Marcellus Shale in PA and NY

Cornell University
College of Agriculture and Life Sciences
Department of Natural Resources

Hello. We are a team of researchers trying to learn more about communities in Pennsylvania's northern tier and New York's southern tier. You were selected for participation in this study because you live in an area where there has been conversation about *shale gas development via hydraulic fracturing*.

Shale gas development, often called "fracking", refers to a range of processes used to prepare for, extract, and transport natural gas that is tightly locked within rock formations deep in the earth. A number of environmental, economic, social, and health-related effects may be associated with shale gas development.

We are interested in your thoughts about your community, its future, and potential effects of shale gas development.

This survey should take less than 20 minutes to complete. Even if you don't have strong views about shale gas development, we would appreciate your input so that our results accurately reflect everyone's thoughts. We will keep your identity confidential; your answers will never be associated with your name.

Thank you very much for your help!

Understanding your community

1. **To what extent do the following characteristics describe your community?** Please check one per row.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
Rural way of life	□	□	□	□	□	□
Unique natural environment	□	□	□	□	□	□
Healthy environment	□	□	□	□	□	□
High quality water resources	□	□	□	□	□	□
Economic stability	□	□	□	□	□	□
People share the same values	□	□	□	□	□	□
Residents can work together to resolve issues	□	□	□	□	□	□
This community can adapt to change	□	□	□	□	□	□

2. Do you agree or disagree with the following statements about your community? Please check one per row.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
Local government does a good job addressing local residents' needs.	□	□	□	□	□	□
Local residents have power to influence policies that affect us.	□	□	□	□	□	□

3. We want to understand the history of natural resource use in your area. Check two boxes in each row, one for each question.

	How much experience has the area you live in had with the following:				**If your area has experience, how positive or negative has this experience been?**			
	None or very little	Some	A great deal		Very negative	Somewhat negative	Somewhat positive	Very positive
Natural gas drilling	□	□	□	→	□	□	□	□
Oil drilling	□	□	□	→	□	□	□	□
Coal mining	□	□	□	→	□	□	□	□
Other mining	□	□	□	→	□	□	□	□
Timber harvesting	□	□	□	→	□	□	□	□

4. Considering everything, do you think your community is better or worse off than it was five years ago? Please circle one.

Much better off	Better off	About the same	Worse off	Much worse off

Understanding your views

5. Please describe your level of involvement in local issues within your community, in general. Circle one.

Not active at all	Not very active	Somewhat active	Very active

6. Please let us know whether you agree or disagree with the following statements about your community.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
I feel close to people who live in my community.	□	□	□	□	□	□
I feel close to people outside my community who share my values.	□	□	□	□	□	□
I care deeply about protecting and improving my community.	□	□	□	□	□	□
My community is special to me as it is; I would not want anything to change.	□	□	□	□	□	□
The land in my community is important because it provides for our people.	□	□	□	□	□	□
The land has its own value, independent of what it provides for us humans.	□	□	□	□	□	□

Shale gas development and your community

7. Please write, as quickly as you can, any words or phrases that come to mind when you think of "shale gas development via hydraulic fracturing".

_____

_____

8. Are you aware of any meetings or rallies on shale gas development that have been held in your community? Please circle one.

No, none	Yes, at least one	Yes, several

9. Please indicate whether you agree or disagree with the following statements about *shale gas development*.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
I formed my views on shale gas development after discussing it with people in my community.	□	□	□	□	□	□
I search out information on this topic on my own.	□	□	□	□	□	□
People in this community feel similarly on this issue.	□	□	□	□	□	□
News coverage (radio, newspapers, TV) on this issue generally supports my views.	□	□	□	□	□	□
I consider myself well informed on the topic of shale gas development.	□	□	□	□	□	□
People who feel as I do about this topic often support their views with facts.	□	□	□	□	□	□
People opposed to my views on this issue are often misinformed.	□	□	□	□	□	□

10. How often have you engaged in the following, with a specific focus on shale gas development? Check one per row.

	Never	Once	More than once
Attended a meeting or rally	□	□	□
Joined a group	□	□	□
Shared information with community members	□	□	□
Signed a petition	□	□	□
Voted for a particular politician	□	□	□
Wrote to a politician	□	□	□
Wrote a “letter to the editor”	□	□	□

11. We're interested in your thoughts on impacts of shale gas development. Check two boxes in each row, one for each question.

	How *likely* do you think the following effects of shale gas development are?					**If it were to occur, how much of an effect would each outcome have on your *quality of life*?**			
	Not at all likely	Not very likely	Likely	Very likely		No effect at all	Little effect	Some effect	A large effect
Increased jobs for locals / our children	□	□	□	□	→	□	□	□	□
Short-term local economic growth	□	□	□	□	→	□	□	□	□
Long-term local economic growth	□	□	□	□	→	□	□	□	□
Increased rental housing prices	□	□	□	□	→	□	□	□	□
Lowered property values	□	□	□	□	→	□	□	□	□
Lower taxes locally	□	□	□	□	→	□	□	□	□
Less tourism locally	□	□	□	□	→	□	□	□	□
Personal income from leasing / royalties on gas	□	□	□	□	→	□	□	□	□
Increased traffic	□	□	□	□	→	□	□	□	□
Worse road quality	□	□	□	□	→	□	□	□	□
Changes in community character	□	□	□	□	→	□	□	□	□
Decreased local beauty	□	□	□	□	→	□	□	□	□
Decreased quality of outdoor recreation	□	□	□	□	→	□	□	□	□
Increased crime	□	□	□	□	→	□	□	□	□

	Not at all likely	Not very likely	Likely	Very likely		No effect at all	Very little effect	Some effect	A large effect
Decreased peace & quiet	□	□	□	□	→	□	□	□	□
Increased stress	□	□	□	□	→	□	□	□	□
Decreased personal / family health	□	□	□	□	→	□	□	□	□
Increased energy independence	□	□	□	□	→	□	□	□	□
Increased industrialization	□	□	□	□	→	□	□	□	□
Decreased air quality	□	□	□	□	→	□	□	□	□
Decreased water quality	□	□	□	□	→	□	□	□	□
Decreased fish & wildlife health	□	□	□	□	→	□	□	□	□
Preservation of agricultural land	□	□	□	□	→	□	□	□	□
Decreased greenhouse gas (carbon) emissions	□	□	□	□	→	□	□	□	□

12. How commonly do you see or hear the following, *associated with shale gas development*, in your area:

	Never	Occasionally	Frequently
Truck traffic	□	□	□
Gas wells or drilling rigs	□	□	□
Noise related to industry or traffic	□	□	□
Increased local economic activity	□	□	□
Changes in the natural landscape	□	□	□
Signs supporting / opposing gas drilling	□	□	□

13. How have you heard or read about *shale gas development*? Please check two boxes in each row, one for each question.

	How often have you read or heard about this issue from each source?				**If you've used it, how helpful has each source been for understanding the issue?**		
	Never	Occasionally	Often		Not helpful	Somewhat helpful	Very helpful
Local newspaper	□	□	□	→	□	□	□
National newspaper	□	□	□	→	□	□	□
Television	□	□	□	→	□	□	□
Radio	□	□	□	→	□	□	□
Family and friends	□	□	□	→	□	□	□
Other people in your community	□	□	□	→	□	□	□
Casual conversations (ex., at the diner, etc.)	□	□	□	→	□	□	□
Internet	□	□	□	→	□	□	□
Social media (ex. Facebook, Twitter)	□	□	□	→	□	□	□
Environmental groups	□	□	□	→	□	□	□
Industry	□	□	□	→	□	□	□
University scientists	□	□	□	→	□	□	□
Cooperative	□	□	□	→	□	□	□
Public meetings	□	□	□	→	□	□	□
NY DEC / PA DEP	□	□	□	→	□	□	□

14. Considering everything, do you support or oppose shale gas development in the following areas? Check one per row.

	Strongly Oppose	Oppose	Slightly Oppose	Slightly Support	Support	Strongly Support
In your community	□	□	□	□	□	□
In your state	□	□	□	□	□	□
In the USA	□	□	□	□	□	□

15. Do you support or oppose a *ban* or *moratorium* (temporary ban) on shale gas development in the following locations:

	Strongly Oppose	Oppose	Slightly Oppose	Slightly Support	Support	Strongly Support
In your community	□	□	□	□	□	□
In your state	□	□	□	□	□	□
In the USA	□	□	□	□	□	□

16. Please let us know how important you believe each of the following should be for decision making on shale gas development (center). Then mark the *two* you think should be *most* important for decision making (at right).

	Not at all important	Not very important	Moderately important	Important	Very important	Extremely important	Put an "X" by the two most important
Preventing harm *at all costs*	□	□	□	□	□	□	
Using caution in light of uncertainty	□	□	□	□	□	□	
Weighing all risks and benefits	□	□	□	□	□	□	
Distribution of risks & benefits (*who* benefits, *who* is harmed)	□	□	□	□	□	□	
A fair and transparent process	□	□	□	□	□	□	
Citizens having a say in decision-making	□	□	□	□	□	□	
Preserving the way of life in my community	□	□	□	□	□	□	
Rights to clean air and water	□	□	□	□	□	□	
People's rights to use their property as they want to	□	□	□	□	□	□	

The future of your community

17. How important do you think the following are to a positive future for communities like yours? Please check one per row.

	Not at all important	Not very important	Moderately important	Important	Very important	Extremely important
Being a community that can "reinvent" itself	☐	☐	☐	☐	☐	☐
Integrating economic, environmental, and social issues in decision making	☐	☐	☐	☐	☐	☐
Being able to absorb and adapt to change	☐	☐	☐	☐	☐	☐
Considering future consequences of decisions	☐	☐	☐	☐	☐	☐
Having a diverse economy	☐	☐	☐	☐	☐	☐
Understanding "tipping points" in how much stress the local environment can handle	☐	☐	☐	☐	☐	☐

About You

18. Please let us know whether you agree or disagree with the following statements. Check one per row.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
A first consideration of a good political system is protection of private property rights.	☐	☐	☐	☐	☐	☐
The balance of nature is very delicate and easily upset by human activities.	☐	☐	☐	☐	☐	☐
Decisions about development are best left to the economic market.	☐	☐	☐	☐	☐	☐

19. Please indicate your sex. Check one.

_____ Female _____ Male

20. In what year were you born? _____

21. Do you have a gas or oil lease on your property? Check one.

___ The mineral rights under my land are leased
If so, in what year was the lease signed? _____
Do you own the lease on mineral rights? ___Yes ___No

___ There has never been a lease on my property.

22. I receive water at my home from: (Please check one.)

___ A private well (groundwater)
___ Town/city water piped from an aquifer (groundwater)
___ Town/city water piped from a surface source

23. How many years you have lived in your current community?

_____ Years

24. For how many generations have you (or your family) lived in your community?

_____ Generations

25. How would you describe your political views? Circle one.

Very Liberal	1	2	3	4	5	6	7	Very Conservative

26. How satisfied are you with your family's financial situation?

Not satisfied at all	1	2	3	4	5	6	7	Extremely Satisfied

27. Please indicate your highest level of education attained.

___ Didn't graduate high school ___ High school graduate / GED
___ Some college
___ Completed 4-year degree ___ Completed graduate degree

28. How much land do you own in the Marcellus Shale region?

_____ acres of land

Thank you for your time and effort!

To return this questionnaire, simply seal it with the white removable seal, and drop it in the mail (return postage has been paid).

Appendix F: Cover letter for initial survey mailing

Cornell University

Department of Natural Resources
Human Dimensions Research Unit
202 Bruckner Hall
Ithaca, New York 14853-4203
t. 607.255.2902
f. 607.254.2299

September 4, 2013

Dear Twin Tiers resident:

Cornell University is trying to better understand how residents in Pennsylvania's northern tier and New York's southern tier view and discuss *shale gas development via hydraulic fracturing*. Often called "fracking", shale gas development has the potential to affect our communities in many ways. We are interested in how you think it will affect your community and your quality of life. We will use this information to inform local and state officials about community residents' values and preferences. We are writing to ask that you participate in our study by completing the enclosed questionnaire.

You were randomly selected for this survey due to living in one of four counties in Pennsylvania (Bradford, Lycoming, Susquehanna, or Wayne) or in one of six counties in New York (Broome, Chemung, Cortland, Delaware, Tioga, or Tompkins). Shale gas development has been discussed heavily in recent years in each of these areas. **Even if you do not have strong views about shale gas development, please fill out and return the questionnaire so that our results reflect everyone's thoughts**.

Please complete your questionnaire as soon as possible, seal it with the white re-sealable label provided, and drop it in any mailbox; return postage has been paid. Your participation in the survey is strictly voluntary, but your response is very important to us. Your identity will be kept confidential and the information you give us will never be associated with your name.

Many thanks for your help with this study!

Sincerely,

Darrick Evensen
Ph.D. student
Department of Natural Resources

Rich Stedman
Associate Professor
Department of Natural Resources

Appendix G: Cover letter for drop-off, pick-up follow up

Cornell University

Department of Natural Resources
315 Fernow Hall
Ithaca, New York 14853
t. 518.339.0685

November 1, 2013

Dear [name of municipality] resident:

Hello. I am a graduate student at Cornell University. I am working with a group of researchers to better understand how residents in New York's Southern Tier view *shale gas development via hydraulic fracturing* (often called "fracking"). I will use this information to help local and state officials better understand community residents' values and preferences.

This is a follow up to a survey we mailed in September. Maybe you did not receive the survey or maybe you did not yet have a chance to fill it out. I would really appreciate your help in filling out the survey because we have received fewer responses from residents in [name of municipality] than in the other towns/cities to which we sent this survey. We want to ensure that the perspectives of [name of municipality] residents are represented equally in our research.

Even if you do not have strong views about or know much about shale gas development, please fill out the questionnaire so that our results reflect everyone's thoughts.

Please just fill out the survey and leave it in the bag where you found it. I will be back in [name of municipality] on Monday to collect these surveys.

Your participation in the survey is strictly voluntary, but your response is very important to us. Your identity will be kept confidential and the information you give us will never be associated with your name.

Many thanks for your help with this study!

Sincerely,

Darrick Evensen
Ph.D. student
Department of Natural Resources
dte6@cornell.edu

Appendix H: Results from survey analysis using weighted data

Descriptive Statistics

Support for / opposition to shale gas development
(Compare with Table 6.1)

Considering everything, do you support or oppose shale gas development in the following areas? Check one per row.

	Strongly Oppose	Oppose	Slightly Oppose	Slightly Support	Support	Strongly Support	Mean
In your community	28.7	8.0	9.8	11.0	18.6	23.9	**3.55** **NY – 2.92*** **PA – 4.21***
In your state	23.3	9.1	7.8	12.8	21.9	25.1	**3.76** **NY – 3.17*** **PA – 4.40***
In the USA	18.6	7.1	9.3	13.3	23.0	28.7	**4.01** **NY – 3.41*** **PA – 4.64***

Note: All numbers in this table (and all other tables in this section) represent the percentage of responses to each variable in each category. The final column in each table presents the mean (average) value for each variable. The scale for the mean is based on the number of response options for that particular variable, as indicated in each table.

Significance of two-tailed independent samples t-test: * $p < 0.001$, † $p < 0.01$, ‡ $p < 0.05$.

Beliefs about impacts of shale gas development
(Compare with Table 6.2)

We're interested in your thoughts on impacts of shale gas development. Check two boxes in each row, one for each question.

	How *likely* do you think the following effects of shale gas development are?					**If it were to occur, how much of an effect would each outcome have on your *quality of life*?**				
	Not at all likely	Not very likely	Likely	Very likely	**Mean**	No effect at all	Little effect	Some effect	A large effect	**Mean**
Increased traffic	2	6	28	65	**3.56**	5	15	31	50	**3.26**
Increased rental housing prices	3	10	31	57	**3.41**	31	21	20	27	**2.43**
Short-term local economic growth	3	11	46	41	**3.25**	12	26	41	22	**2.73**
Worse road quality	8	20	23	49	**3.12**	9	16	28	47	**3.13**
Decreased peace & quiet	5	24	32	39	**3.04**	8	20	31	41	**3.05**
Changes in community character	6	22	35	37	**3.03**	9	26	31	34	**2.90**
Increased industrialization	6	22	42	31	**2.98**	9	24	38	30	**2.88**
Increased jobs for locals / our children	8	24	33	35	**2.96**	16	25	33	25	**2.68**
Decreased water quality	11	29	21	39	**2.88**	11	20	17	52	**3.11**
Decreased local beauty	12	25	24	39	**2.91**	11	23	27	39	**2.94**
Decreased fish & wildlife health	13	28	22	37	**2.82**	12	21	24	43	**2.96**
Increased crime	13	32	27	28	**2.69**	14	24	28	34	**2.82**
Increased energy independence	15	31	27	27	**2.67**	16	26	31	27	**2.69**
Decreased quality of outdoor recreation	17	29	21	33	**2.71**	17	23	24	37	**2.81**
Increased stress	16	28	28	28	**2.68**	18	23	30	30	**2.72**

	Not at all likely	Not very likely	Likely	Very likely	**Mean**
Personal income from leasing / royalties on gas	23	16	29	31	**2.69**
Decreased air quality	16	34	20	30	**2.65**
Long-term local economic growth	16	31	27	26	**2.62**
Preservation of agricultural land	19	31	25	25	**2.57**
Decreased personal / family health	20	35	22	22	**2.47**
Lowered property values	21	36	23	21	**2.43**
Decreased greenhouse gas (carbon) emissions	24	37	25	14	**2.30**
Less tourism locally	21	43	22	15	**2.30**
Lower taxes locally	29	45	19	7	**2.03**

	No effect at all	Very little effect	Some effect	A large effect	**Mean**
Personal income from leasing / royalties on gas	34	17	23	25	**2.40**
Decreased air quality	15	22	24	40	**2.88**
Long-term local economic growth	15	25	35	24	**2.68**
Preservation of agricultural land	10	24	31	36	**2.92**
Decreased personal / family health	20	24	22	33	**2.68**
Lowered property values	16	24	28	32	**2.76**
Decreased greenhouse gas (carbon) emissions	12	30	32	26	**2.73**
Less tourism locally	34	34	20	12	**2.10**
Lower taxes locally	15	28	31	27	**2.70**

Ethical rationales for regulating shale gas development
(Compare with Table 6.3)

Please let us know how important you believe each of the following should be for decision making on shale gas development (center). Then mark the *two* you think should be *most* important for decision making (at right).

	Not at all important	Not very important	Moderately important	Important	Very important	Extremely important	% that selected this option as one of the two most important	**Mean**
Rights to clean air and water	1	1	2	16	21	61	49	**5.38**
A fair and transparent process	0	1	3	23	26	46	18	**5.13**
Weighing all risks and benefits	1	1	4	22	28	45	19	**5.10**
Citizens having a say in decision-making	1	1	7	23	27	40	14	**4.96**
Using caution in light of uncertainty	1	3	4	25	27	40	11	**4.93**
Preserving the way of life in my community	1	2	8	25	26	40	11	**4.91**
People's rights to use their property as they want to	2	3	7	21	22	46	34	**4.93**
Preventing harm *at all costs*	2	3	6	24	23	42	41	**4.89**
Distribution of risks & benefits (*who* benefits, *who* is harmed)	3	3	8	24	27	35	6	**4.75**

Factor analyses

Factor analysis of beliefs about impacts (likelihood * effect on life)
(Compare with Table 6.24)

	Component	
	1 (Beliefs about Risks)	2 (Beliefs about Benefits)
Increased jobs (**L**ikelihood * **E**ffect on life)		**.834**
Short-term local economic growth (L * E)		**.825**
Long-term local economic growth (L * E)	-.350	**.809**
Lowered property values (L * E)	**.669**	
Lower taxes locally (L * E)		**.351**
Less tourism locally (L * E)	**.562**	
Personal income from royalty / lease (L * E)		**.723**
Increased traffic (L * E)	**.709**	
Worse road quality (L * E)	**.765**	
Changes in community character (L * E)	**.842**	
Decreased local beauty (L * E)	**.818**	-.318
Dec. quality of outdoor recreation (L * E)	**.832**	-.258
Increased crime (L * E)	**.741**	
Decreased peace & quiet (L * E)	**.818**	
Increased stress (L * E)	**.810**	
Decreased personal / family health (L * E)	**.772**	-.327
Increased energy independence (L * E)		**.627**
Decreased air quality (L * E)	**.822**	-.305
Decreased water quality (L * E)	**.791**	-.368
Decreased fish & wildlife health (L * E)	**.792**	-.354

Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization; Rotation converged in 3 iterations.

* All loadings suppressed with absolute value less than 0.25.

The eigenvalues were 10.07 for factor 1 and 2.51 for factor 2, leading to an explained variance of 50.3% and 12.6%, for a total variance explained between the two factors of 62.9%. A reliability analysis of the fourteen impacts in factor 1 produced a Cronbach's alpha of 0.957. Deletion of only one impact would increase reliability, and only by 0.002. A reliability analysis of the six impacts in factor 2 produced a Cronbach's alpha of 0.843. Deletion of only one impact would increase reliability, by 0.013.

Linear regressions

Linear regression with benefits and risks regressed on support/opposition
(Compare with Table 6.26)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	Beta	Std. Error	Beta		
(Constant)	4.202	.117		35.953	.000
Beliefs about risks (composite variable)	-.382	.016	-.547	-23.945	.000
Beliefs about benefits (composite variable)	.349	.019	.425	18.596	.000

Dependent Variable: Support for / opposition to shale gas development (combined across community, state, and nation)
Adjusted $R^2 = 0.70$.

Linear regression of support/opposition on multiple predictors
(Compare with Table 6.27)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	Beta	Std. Error	Beta			Tolerance	VIF
(Constant)	2.239	.984		2.276	.024		
Age (in years)	.025	.007	.227	3.846	.000	.839	1.192
Sex (1 = Male, 0 = Female)	.490	.219	.129	2.237	.027	.880	1.137
Pos./neg. experience with resource extraction	.611	.134	.270	4.547	.000	.825	1.213
Have lease? (1 = Yes, 0 = No)	1.134	.241	.277	4.695	.000	.835	1.197
Signs about gas drilling in your community	-.372	.154	-.141	-2.416	.017	.854	1.171
"My community is special as is; I would not want any change"	-.214	.070	-.176	-3.039	.003	.866	1.154
"A first consideration of a good political system is protection of private property rights"	.298	.112	.153	2.649	.009	.872	1.146
"The balance of nature is very delicate and easily upset by human actions"	-.445	.134	-.220	-3.326	.001	.667	1.500

Dependent Variable: Support for / opposition to shale gas development (combined across community, state, and nation)
Adjusted $R^2 = 0.58$.

Appendix I: Codes for open-ended survey question

Overall code	Descriptions and Sub-categories
1. General references to oil, gas, energy, rock	Oil, (natural) gas, energy, oil/gas companies, oil well, oil from shale, shale, fossil fuels, fuel
2. References to process of fracking (i.e. drilling or mining) while mentioning oil/gas	Get gas out of the ground, drilling for gas, breaking rock to drill for oil/gas, getting gas/oil from shale, hydrofracking, fracking
3. Statements that **may** be relevant to the process of fracking, but it's unclear if they are (i.e. vague; no reference to oil/gas/fossil fuel, etc.)	Drilling/mining, cracking the rock, energy development, cracking, breaking, broken, fracturing, digging up, water and chemicals, sand
Impacts often associated with fracking/shale gas development (with or without specifically mentioning fracking)	**4. Environmental** – References to environmental impacts (e.g., earthquakes, water contamination, water, environmental harm, explicit use of words "environment" or "environmental")
	5. Economic – economic development, jobs, cheap energy, lower/higher energy prices, money, **and/or Energy independence/supply**: increase in oil, gas supply, energy security, independence
	6. Social – impacts on residents, communities, infrastructure, roads, services, human health impacts
	7. (Political) controversy – controversy, controversial, protests, citizen unrest, comments about shale gas development being a loaded topic, etc.
8. Stance on shale gas development	Statements/adjectives that describe how one feels about fracking with or without specific references to process or impacts. Such statements can be: (8a) **Good/positive**: "good, OK, let's do it, they should allow it" (8b) **Bad/negative**: "bad, dangerous, pollution, contamination, dirty, destruction, poison, damage" (8c) **Other, mixed, or unclear/conflicting valence**, but still reflects a stance on shale gas development. Respondent expresses caution or hesitancy in his/her stance (i.e., cautious, can fracking be controlled?, necessary to an extent, need for research, conflicting feeling, confusion, unclear attitude)
9. Comments about the word "fracking"	"Strange word," "sounds nasty," references to sex, references to Battlestar Galactica

	** Also, anything that begins with "sounds like…"
10. Statements that **may** be relevant to the general issue of fracking, but it's unclear if they are	References to particular individuals like elected officials (e.g., Governor Cuomo), tangential issues (e.g., global warming, climate change, gasoline), etc.
11. References to geological formations	Marcellus Shale, etc.
12. References to geographic locations	New York State, Pennsylvania, specific counties, specific municipalities, etc.
13. Respondent is unsure, does not know, or indicates he/she cannot think of a response	All responses related to lack of respondent familiarity with, knowledge of fracking; states that he/she can't think of a response; nothing comes to their mind; unsure (of issues, process, effects); uncertainty, uncertain, unknown, curious, curiosity, "haven't made up my mind"
14. Irrelevant statements	Clearly NOT relevant to any shale gas development process, issue, or stance (e.g., storms; TV; events/energy issues that don't involve shale gas, such as the 2010 Deepwater Horizon Oil Spill)

Appendix J: M*plus* code for single-level SEM

```
Title: Shale gas SEM, second-order factor analyses, multiple predictors of support/opposition;
Data:
  FILE IS D:\Shale_data_for_SEM_final.csv;
Variable:
  NAMES ARE town, county, state, popul, popden, soc_edu, poverty, unemploy,
  income, pol_co, wells, wells_co, violate, v1-v168, f1-f24, m1-m39,
  c1-c17, c_impact, c_valenc, eth1-eth9;
  USEVARIABLES ARE v26 v100 v131-v133 v148-v155 v159 v165
  m1-m3 m5-m18 m20-m22;
  MISSING ARE ALL (99);
Model:
  support ON v26 v100 v154 v155 v159 v165;
  resilnce BY v148 v149 v150 v152;
  sustain BY v149 v151 v153;
  environ BY m20* m21 m22;
  growth BY m1* m2 m3;
  charactr BY m9* m10 m11 m14 m15;
  beauty BY m11* m12 m13;
  health BY m15* m16 m17 m20;
  risks BY m7*1.0 m5 environ charactr beauty health;
  benefits BY m6*1.0 m8 m18 growth;
  support BY v131 v132 v133;
  environ@1 growth@1 charactr@1 beauty@1 health@1;
  risks ON support v155;
  benefits ON support;
  charactr ON growth;
  resilnce ON support;
  sustain ON support v155;
  benefits WITH charactr;
  m9 WITH growth;
  benefits WITH risks@0;
  risks WITH resilnce@0;
Output:
  STANDARDIZED;
```

Appendix K: M*plus* code for single-level SEM accounting for complex survey data

```
Title: Shale gas SEM, replication of original single-level SEM, with municipality as complex
       stratification variable;
Data:
  FILE IS D:\Shale_coded_correctly.csv;
Variable:
  NAMES ARE town, county, state, popul, popden, soc_edu, poverty, unemploy,
  income, pol_co, wells, wells_co, violate, v1-v168, f1-f24, m1-m39,
  c1-c17, c_impact, c_valenc, eth1-eth9;
  USEVARIABLES ARE town, v26, v100, v131-v133, v148-v155, v159,
  v165, m1-m3, m5-m18, m20-m22;
  MISSING ARE ALL (99);
  STRATIFICATION IS town;
Analysis:
  Type = COMPLEX;
Model:
  support ON v26 v100 v154 v155 v159 v165;
  resilnce BY v148 v149 v150 v152;
  sustain BY v149 v151 v153;
  environ BY m20* m21 m22;
  growth BY m1* m2 m3;
  charactr BY m9* m10 m11 m14 m15;
  beauty BY m11* m12 m13;
  health BY m15* m16 m17 m20;
  risks BY m7*1.0 m5 environ charactr beauty health;
  benefits BY m6*1.0 m8 m18 growth;
  support BY v131 v132 v133;
  environ@1 growth@1 charactr@1 beauty@1 health@1;
  risks ON support v155;
  benefits ON support;
  charactr ON growth;
  resilnce ON support;
  sustain ON support v155;
  benefits WITH charactr;
  m9 WITH growth;
  benefits WITH risks@0;
  risks WITH resilnce@0;
Output:
  STANDARDIZED;
```

Appendix L: M*plus* code for two-level SEM with three factor analyses

```
Title: Shale gas SEM, multi-level SEM by towns (28), three CFAs and two structural pathways;
Data:
  FILE IS D:\Shale_coded_correctly.csv;
Variable:
  NAMES ARE town, county, state, popul, popden, soc_edu, poverty, unemploy,
  income, pol_co, wells, wells_co, violate, v1-v168, f1-f24, m1-m39,
  c1-c17, c_impact, c_valenc, eth1-eth9;
  USEVARIABLES ARE town pol_co v131-v133 m1-m3 m5-m18 m20-m22;
  MISSING ARE ALL (99);
  WITHIN = ;
  BETWEEN = pol_co;
  CLUSTER = town;
Analysis:
  Type = TWOLEVEL;
  ESTIMATOR = WLSMV;
Model:
  %WITHIN%
  environw BY m20* m21 m22;
  growthw BY m1* m2 m3;
  charactw BY m9* m10 m11 m14 m15;
  beautyw BY m12* m13;
  healthw BY m16* m17;
  riskw BY m7 m5 environw* charactw beautyw healthw;
  benefitw BY m6 m8 m18 growthw*;
  supportw BY v131 v132 v133;
  environw@1 growthw@1 charactw@1 beautyw@1 healthw@1;
  riskw ON supportw;
  benefitw ON supportw;
  %BETWEEN%
  riskb BY m7 m5 m9-m17 m20-m22;
  benefitb BY m6 m1-m3 m8 m18;
  supportb BY v131-v133;
  v131-v133@0;
  riskb ON supportb;
  benefitb ON supportb;
  riskb WITH benefitb@0;
  supportb ON pol_co;
Output:
  STANDARDIZED;
```

Appendix M: M*plus* code for two-level SEM, Bayesian estimation

```
Title: Shale gas SEM, multi-level SEM by towns (28), 2-level with BAYES estimation;
Data:
  FILE IS D:\Shale_coded_correctly.csv;
Variable:
 NAMES ARE town, county, state, popul, popden, soc_edu, poverty, unemploy, income, pol_co,
    wells, wells_co, violate, v1-v168, f1-f24, m1-m39, c1-c17, c_impact, c_valenc, eth1-eth9;
  USEVARIABLES ARE town pol_co v131-v133 m1-m3 m5-m18 m20-m22;
  MISSING ARE ALL (99);
  BETWEEN = pol_co;
  CLUSTER = town;
Analysis:
  Type = TWOLEVEL;
  ESTIMATOR = BAYES;
  THIN = 10;
  BITERATIONS = (10000);
  PROCESSORS = 2;
Model:
  %WITHIN%
  environw BY m20* m21 m22;
  growthw BY m1* m2 m3;
  charactw BY m9* m10 m11 m14 m15;
  beautyw BY m12* m13;
  healthw BY m16* m17;
  riskw BY m7 m5 environw* charactw beautyw healthw;
  benefitw BY m6 m8 m18 growthw*;
  supportw BY v131 v132 v133;
  environw@1 growthw@1 charactw@1 beautyw@1 healthw@1;
  riskw ON supportw;
  benefitw ON supportw;
  %BETWEEN%
  riskb BY m7* m5 m9-m17 m20-m22;
  benefitb BY m6* m1-m3 m8 m18;
  riskb@1 benefitb@1;
  supportb BY v131-v133;
  v131-v133@0.01;
  riskb ON supportb;
  benefitb ON supportb;
  riskb WITH benefitb@0;
  supportb ON pol_co;
Output:
  STANDARDIZED TECH1 TECH8;
Plot:
  Type = plot3;
```

Appendix N: M*plus* code for two-level SEM with one factor analysis

```
Title: Shale gas SEM, multi-level SEM by towns (28), one CFA and multiple structural
       regression pathways;
Data:
  FILE IS D:\Shale_coded_correctly.csv;
Variable:
  NAMES ARE town, county, state, popul, popden, soc_edu, poverty, unemploy,
  income, pol_co, wells, wells_co, violate, v1-v168, f1-f24, m1-m39,
  c1-c17, c_impact, c_valenc, eth1-eth9;
  USEVARIABLES ARE town pol_co v26 v100 v131-v133 v154-v155 v159 v165;
  MISSING ARE ALL (99);
  WITHIN = v26 v100 v154-v155 v159 v165;
  BETWEEN = pol_co;
  CLUSTER = town;
Analysis:
  Type = TWOLEVEL;
  ALGORITHM = INTEGRATION;
  INTEGRATION = 10;
  ESTIMATOR = WLSMV;
Model:
  %WITHIN%
  supportw ON v26 v100 v154 v155 v159 v165;
  supportw BY v131 v132 v133;
  %BETWEEN%
  supportb BY v131-v133;
  v131-v133@0;
  supportb ON pol_co;
Output:
  STANDARDIZED;
```

References:

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